CHEMICAL & METALLURGICAL ENGINEERING

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CHEMICAL & METALLURGICAL ENGINEERING

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Is an Oil-Shale Revival in Prospect?

DURING the boom days of 1919 and 1920 and perhaps as a part of the after-war fever of speculation that spread over the entire country, oil-shale reached its height of popular interest. Under this generous patronage literally hundreds of promotional schemes flourished and bloomed only to wither and dry up once business depression and unfavorable conditions in the oil industry made their appearance. Just within the past few weeks, however, a number of developments have occurred that old timers regard as indicative of renewed interest in our oil-shale resources. Fortunately these signs point in the direction of sound technical and economic progress rather than to sensational and purely speculative development.

Indirectly the Presidential Oil Commission—George Otis Smith, Rear Admiral Hilary P. Jones and Lieutenant Commander M. C. Robertson—are responsible for the present revival. As a part of its investigation of the Government's oil resources, the Commission directed attention to the naval oil-shale reserves—45,000 acres in Colorado and 86,000 acres in Utah of what appears to be the country's richest deposits. Apparently the Commission appreciated the fact that the possession of these reserves was a responsibility for their development. If these reserves are going to be useful when the time comes that the Navy must rely on them, proved methods and equipment for extracting the oil must be available. It is to the public interest that the Navy be prepared. To depend upon the oil companies and private corporations for the necessary development may prove an unwarranted risk. Furthermore, it is generally held that large-scale investigation at this time by the Government would accelerate private enterprise and thus aid in accomplishing the desired objective—namely, securing an adequate and dependable supply of fuel for the Navy and for the nation.

While the ultimate results of this oil-shale revival are not yet evident some of the immediate effects are at least significant. The Federal Budget Bureau, which never before in its history has approved a direct appropriation for oil-shale investigation, has authorized a fund of $90,000 to be used for this purpose by the Bureau of Mines. At the insistence of Senator Phipps the deficiency bill which Congress failed to pass before its present recess, also included a similar provision for $50,000. And there is always the hinted possibility that in case of necessity the Navy might be able to divert a part of its funds to the Bureau of Mines with the understanding that that organization, because of its long experience in research, would construct and operate a large-sized experimental plant on the naval reserve. That this subject is at least under consideration would be implied by the recent visit and inspection of the naval property by Admiral Rousseau and representatives of the Bureau of Mines and Geological Survey. A reference to this inspection will be found in the news columns of this issue.

The chemist and chemical engineer will welcome this return of general interest in oil-shale technology. Even the lull that had such a terrific mortality among the promoters has not greatly discouraged fundamental research in the laboratories of a number of universities and larger oil companies. However, with confidence restored in the ultimate future of oil-shale, its many problems—economic and technologic—will be attacked with new vigor and better promise of success.

The Living Cell as a Chemical Engineering Unit

CATHOLICITY of interest is one of the most important prerequisites to successful specialization; and those who have at least an elementary knowledge of all the various branches of chemistry and chemical engineering may be said to have acquired a liberal education. The time has come when dividing lines must be ignored, and the problems tackled with all the tools available. Research in many instances must include investigations as to what is being done by Nature, as well as what can be done by man. And this brings a realization of the potential importance of biochemistry and its allied sciences—the value to the chemist of a general knowledge of elementary physiology and biology. An exact understanding of the various chemical processes associated with the metabolism of the living cell may yet rank among the greatest discoveries to be made by science.

The fixation of atmospheric nitrogen, for instance, is a problem that may be solved in part by a study of what Nature can do without our aid. And it is significant that the possibilities of biochemistry in this connection are being recognized in national research at the present time. Although doubt has been cast on some of the results obtained by the observation of the nitrogen-fixation properties of certain seaweeds, the work will be repeated until definite results are available. The nitrification of the soil by leguminous crops is a well-known phase of farming, but research will doubtless point a way to a more scientific utilization of the activities of the bacteria responsible. No one who has observed the results of the controlled multiplication of the yeast plant in a fermentation vat could fail to be impressed with the possibilities existing for the manufacture of chemical products by the scientific propagation of the lower forms of life.

One of the most positive and interesting examples of the potentialities of bacterial action is seen in the work done by Dr. J. G. Lipman and his staff at the New Jersey Agricultural Station, on the production of

soluble phosphate from insoluble phosphate rock. The ground rock is mixed with commercial flour sulphur. Cultures of sulphur-oxidizing bacteria are then added, and the mixture is kept at a suitable degree of moisture and temperature. The sulphur oxidizes to sulphuric acid, which attacks the phosphate rock, producing water-soluble or citrate-soluble phosphate. Superphosphate has been made thus, and used in agricultural work with results equalling those obtainable with the commercial compound.

Science is on too firm a foundation to justify scepticism as to the outcome of worth-while research in any branch of chemistry, especially in connection with those newer developments in which unseen and to a great extent unknown cell metabolism is an important factor. The time is approaching when it will be necessary for all chemists to possess an appreciation at least of the various processes underlying the growth and multiplication of the simple living cell. The fascination of biochemistry is such that interest in this comparatively new science can be created and maintained without tiresome effort.

The Wisdom of Sunday Supplements

JUST about the time we reach the conclusion that chemists, chemistry and chemical engineering are finding intelligent acceptance by the great mass of the people our complacency receives a jolt that is disheartening. Curiously enough the daily newspapers, those great modern instruments of education and dissemination of knowledge, are the worst offenders in giving the public the wrong idea of our profession and its relation to daily life and public welfare.

For some reason or other, the Sunday supplement editor's concept of chemistry does not seem to rise above pills and potions, Latin names and bad smells. Thus the New York *Herald-Tribune* published last Sunday in its rotogravure section a picture of Senator Ladd of North Dakota standing in his laboratory. Of course the Senator is known to chemists because he had a reputation in that branch of science before he went into politics. But the public will get an entirely wrong idea of the nature of his professional work and that of his confreres if it relies on the stupid caption to the picture. It is a good picture, both as regards the Senator and his laboratory, but we doubt not that the Senator himself will be surprised to learn that he is "back again among his pestles and his pills, posing for a picture which demonstrates his complete familiarity with all the chemical formulas."

Pestles and pills! This evidence of abysmal ignorance is equalled only by the curious notion that the picture demonstrates any familiarity with chemical formulas. We concede to the Senator a knowledge of chemistry; but the newspaper man's idea of chemical wisdom is that "the queer prescription filled with Latin and hieroglyphics which your doctor gives to you is as simple as A B C to the Senator." Perhaps! But if the Senator should confess to us that his knowledge of Latin had long since faded away, that he could not even recite the table of Apothecaries' weight and could not distinguish between hieroglyphics for a scruple and a dram our respect for him as a chemist would be in no wise diminished. Evidently it will take the combined effort of the thousands of chemically-trained men and women in the United States to educate the hundreds of Sunday supplement writers out of their notions that pills, potions and unintelligible prescriptions are the visible evidences of the great science of chemistry.

Competition of a State With Its Own Citizens

TIME and again there arises criticism of state and federal agencies for doing business in competition with private consultants or branches of industry. Often this criticism is not merited but is based upon a misunderstanding of the facts. But there is ample ground for enough unfavorable comment to justify strong commendation when particularly effective schemes for avoiding this difficulty are found.

One such plan of eliminating any cause for hard feeling has been developed by the agricultural experts of the University of Minnesota state farm school group. These men have innumerable calls from producers and users of agricultural products for analyses, tests and free advice. To avoid undue demand for such service a very ingenious plan prevails. In the first place the fees charged are about double those charged for the same work in commercial laboratories. This alone is a sufficient deterrent for 90 per cent of the inquirers. In the second place, the state men make their prospective clients wait their turn to unusual degree. Particularly they insist that such special testing work, except that of unusual importance in the public interest, shall be done only when it does not interfere with the research work on which the specialists are primarily engaged. And when routine waits for research, there is little chance of prompt service.

The combination of high fees and delayed tests has practically solved the problem of excessive commercial testing in the case referred to. It seems likely that a similar remedy would cure much of the difficulty complained of in other places.

The Food Of Giants

ACCORDING to widely disseminated newspaper accounts, Dr. Victor G. Heiser, director in the Far East of the International Health Board of the Rockefeller Foundation, is convinced of the genuineness of the claims made by a member of the Japanese Institute of Nutrition in regard to the almost miraculous powers of fish powder as a cure for arrested development and for increasing stature. Experiments with animals have proved successful; and, one may assume, the Japanese may yet become a race of giants! Details are lacking, but it would seem that there is agreement that the comparatively short stature of the Japanese may be due to the result of an unbalanced diet throughout many centuries. Fish flour may supply the corrective needed to insure normal development.

The manufacture of fish flour is one of the latest offsprings of the American chemical industries, using unit process equipment. The product has found immediate acceptance in Europe and the East; and at least one large remodeled plant, at Monterey, Calif., will be in operation in a few months. The cooked and boned fish are passed through a rendering machine, whereby most of the oil is expelled, then dried and finely ground. The product is carefully screened to insure uniformity. A dietitian is at work at one of the leading universities developing methods of use for ordi-

nary domestic consumption. Biochemical research may disclose the presence of yet another vitamin in this foodstuff, for which so much is claimed in Japan.

Supporting Sales With Service

IN METALS as in many other products, American producers have found themselves confronted since the war by keen competition from foreign manufacturers. In most cases, with the assistance of tariff protection, a reasonable share of domestic business has been retained; but too often comparisons of domestic and foreign supplies have been made solely on price considerations and the business has gone abroad.

One large metal producer in this country seems very satisfactorily to have met the problem of cheap imports of a competing product. The imported material had proved to be of rather irregular composition and not infrequently of inferior quality. Taking advantage of this fact the domestic producer sought by every means possible not only to maintain a high quality product, but also to render technical service to his customers. He has gone so far as to help out certain purchasers of foreign material when they have been in difficulty and have turned to the only available source of advice, the domestic manufacturer. The result has been a most satisfying return of the customers to the domestic product. In fact, one of the principal technical men of this company recently remarked, in expressing his satisfaction with the present situation, "It is evident that our customers prefer service. They are thoroughly disgusted with the 'take it and whistle' policy which prevails in the purchase of imported material."

Other companies confronted with a similar problem may find it profitable to imitate this policy and to render technical service to users of their material, even to a point that seems at the moment an extravagant expenditure in support of sales. In any event, mixing a little chemistry and chemical engineering with the sales effort is bound to be helpful.

"We've Kept Our Salesmen Talking Facts"

A SUCCESSFUL leader of industrial research preached a whole sermon in a sentence when he spoke thus of the relations between his department and the sales department of his corporation. Furthermore, he exhibited a vision of research service that could profitably materialize in the efforts of many other research laboratories.

It is a common complaint that the salesman gets a disproportionately large salary as compared with the investigator or plant engineer. This disparity in salary may be too great in some cases; but taken by and large, salesmen have great potentialities for making money for their companies, and it is inevitable that the man who brings in the orders which mean income will often be more welcome in the boss' office than the man who spends the money for research or OK's labor material and overhead expenditures for the plant.

There is only one way in which to correct such a condition, and that is to establish as vigorous a sales research and sales engineering policy in the laboratory and plant as is consistent with the organization of the company, to augment sales as well as to reduce costs or improve products. The research man should be, and in well managed corporations is, consulted as to the feasibility of sales in certain fields. He is also consulted regarding the correctness of advertising literature and sales propaganda. If the director of research has a proper sense of commercial balance he will not frown upon these diversions from pure science but will welcome the opportunity to do as was done by the research director above quoted when he said "We've kept our salesmen talking facts—not hot air."

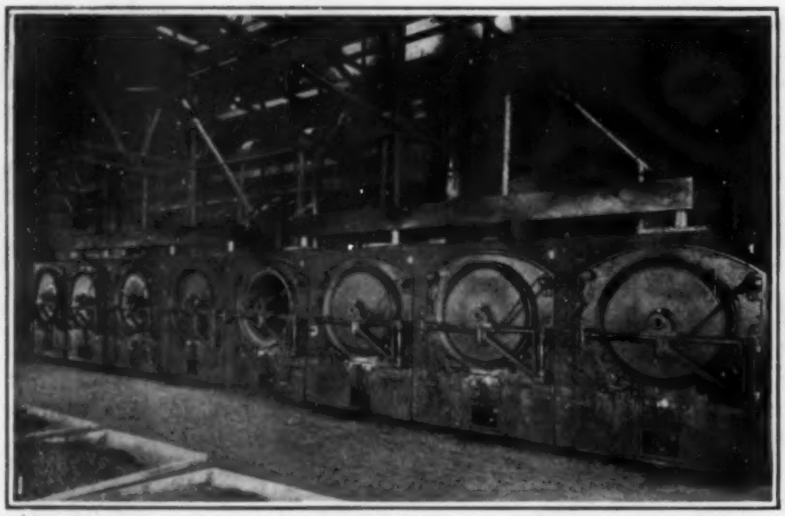
Lumber Waste and The High Cost of Rags

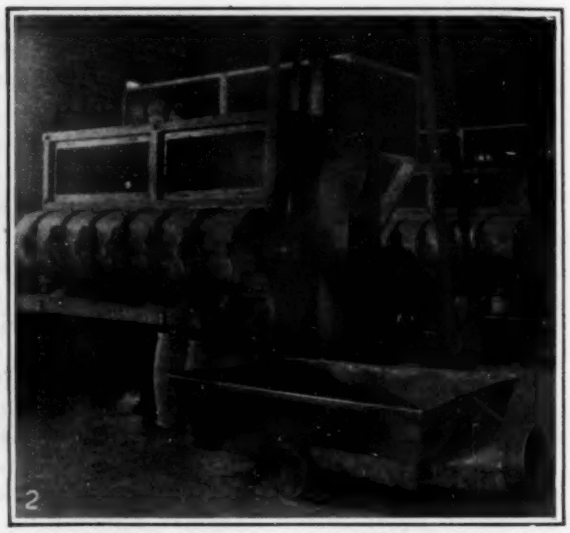
NECESSITY often acts as a spur to the development of inventive initiative that otherwise might lie dormant. An interesting sidelight on the utilization of one of the waste products of the California lumber industry is seen in the manufacture of prepared roofing from redwood bark—a wartime economy that has persisted in spite of the decline in the price of rags. During the war the supply of such fibrous material was seriously curtailed. Imports dwindled to almost nil, and domestic waste was reduced to a minimum at resulting high prices. As a consequence the research staff of the Paraffine Companies, Inc., in California investigated the possibilities of using a wood base in place of the customary rags, the felt produced being impregnated in the usual manner with asphalt and faced with crushed mineral. Experimentation demonstrated the value of redwood bark, the toughness of which may be gaged from the fact that disintegration by saw is economically impossible, because of frequent breakage of the teeth. The company then developed, at considerable expense, a special chopping machine for shredding the bark, three of which are now in successful operation. Not only has this made possible the utilization of a waste product of the California lumber industry, but this progressive company is now able to obtain its raw material largely from local sources.

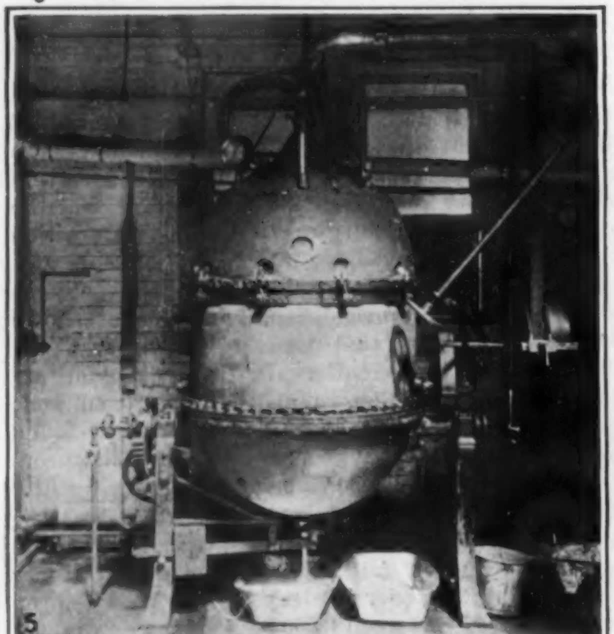
A Sign Of the Times

AN EVIDENCE of progressive metallurgical practice is found in the fact that the first consultant specializing in the use of the X-ray in industry has made his appearance. This corroborates to a certain extent a statement recently made to the effect that the X-ray as a tool of metallurgy occupies today a position attained by the metallographic microscope 20 years ago. But the industrial promise of the X-ray is fully as great as, or probably even greater than, that shown by the microscope at that time. The value of the results obtained by scientists in X-ray crystal analysis is already well known and accepted, and none can say to what extent the X-ray will be found useful when applied more generally to industrial problems. Already it has proved to be of the greatest utility to the large companies that have installed it in their laboratories. But such installations are expensive, and no matter how much faith the smaller manufacturer may have in this modern scientific tool he has been practically forced to forego their advantages.

One way around this obstacle has now appeared: a consulting service to which the small manufacturer may apply for solution of his problem. This is typical of the small beginnings of the application of new scientific knowledge to industrial purposes. With wider experience and greater familiarity with the X-ray its application will spread with profit to all concerned.







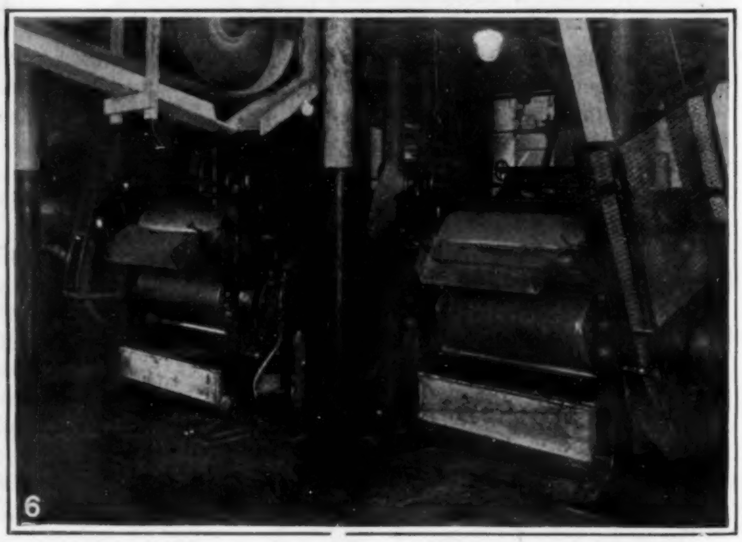


Fig. 1—Oil-Heated Roasters, Each With Motor-Driven Inner Cylinder

Fig. 2—Cracking and Husk-Separating Machines, With Cooling Truck in the Foreground

Fig. 3—Triple Cacao Mills, Taking the Dry Beans and Producing a Liquor

Fig. 4—Hydraulic Presses That Are Used for Expression of Excess Fat

Fig. 5—Vacuum Pan Used for the Concentration of Milk That Is Later Used in Compounding

Fig. 6—Three-Roll Refiners, on Which the Chocolate Paste Is Finely Disintegrated

From Cacao to Cocoa and Chocolate

The Production of These Materials Involves Chemical Engineering Processes That Emphasize Underlying Interconnection With Other Industries

PERMANENT corruption of language follows an apathetic acceptance and a continued repetition of mistaken pronunciation, and literature often becomes based on accepted rather than on logical usage. Thus cacao at some early date became corrupted to cocoa, and much confusion has resulted. Albeit, both forms must be used. The word chocolate is a close derivation of chocolatl, a cacao beverage that was consumed in quantity by the Aztecs. The cacao tree was indigenous to Mexico, and a consignment of beans was taken to Spain in the early days of the sixteenth century by the returning conqueror, Cortez, and the beverage into which they were made found immediate favor. *Theobroma cacao*, as Linnæus named it, "food of the gods," is now a plantation product, the world's output coming principally from the tropical Americas, Africa and India. The raw material used in the plant to be described later in this article comes from Ecuador, Trinidad and Brazil. The tree as cultivated is about 16 ft. high. Each inflorescence culminates in a ribbed, purplish fruit pod, about 8 in. long and 4 in. in diameter. This contains five cells, containing a pulp in which is embedded from twenty to forty almond-shaped beans usually purple in color, but white in some species.

History of Process

The various phases of primitive research may be reconstructed thus: It was necessary to rid the beans of the adhering pulp, then to dry them. It was evidently found that the preliminary stage of operations could be simplified and labor obviated by allowing Nature to take its course. If the broken pods are thrown in a heap, fermentation occurs, the pulp is loosened and the beans can be recovered in a fairly clean condition. Moreover, it was found that the chemical changes occurring during fermentation improved the flavor of the bean and effected a desirable change of color. The practice has therefore persisted, and fermented beans command a higher price than do the unfermented variety.

The chemistry of fermentation of the cacao bean has been studied recently in the West Indies, and details of scientific work are available. Suffice to say that yeast fungi and acetic acid bacteria play important parts in the reactions that occur. Starch is converted into soluble dextrine and sugar into alcohol. The loss of weight during fermentation, usually practiced in false-bottomed "sweat" boxes at the plantation and taking from 6 to 12 days, amounts to about 60 per cent, most of which is water. Strict control of fermentation, with particular reference to time and temperature, is necessary to avoid the production of butyric acid. The beans are then washed, slowly dried and sacked for shipment.

The cocoa and chocolate plant of the D. Ghirardelli Co. at San Francisco overlooks the Golden Gate; operations date from 1852, but equipment has been modernized from time to time to keep abreast with mechanical developments, although the method of manufacture has undergone few modifications since its inception. The most important change made in recent years involved the electrification of the plant, which now absorbs 820 hp., distributed by seventy-one motors, using alternating current at 220 volts, two-phase, supplied by the Great Western Power Co.

Details of Processing

The various steps in the manufacture of cocoa and chocolate are of interest to unit process chemical engineers are as follows:

1. Sorting by air suction and gravity, to remove débris, followed by hand picking.
2. Roasting, to dry the bean and permit the easy removal of husk, to effect a darkening in color and improvement in aroma.
3. Treatment of the roasted bean with alkali, in the preparation of an easily miscible powder, misnamed soluble cocoa, which is preferable to earlier practice of adulteration with a starchy substance such as arrowroot.
4. Cracking of the roasted bean, prior to winnowing, for the removal of the husk.
5. Grinding of the bean and the production of a fluid pulp, or cacao liquor.
6. Treatment of a part of the pulp in hydraulic presses, whereby the cacao butter content is reduced to about 25 per cent.
7. Disintegrating the press cake and screening the product in the preparation of "powdered" or "breakfast" cocoa.
8. The mixing of cacao liquor with sugar and additional cacao butter, the cooling and grinding of the mass between rolls, and its remelting to permit molding of the resultant sweetened chocolate into bars suitable for marketing.
9. The mixing of cacao liquor with evaporated whole milk, sugar and additional cacao butter, the refining of the mass on water-cooled rolls, and the manipulation

Of three well-known non-inebriating beverages, cocoa is the only one that combines nourishment with stimulation. The high food value of chocolate is well known. Not only does it contain the initial amount of fat found in the bean, averaging nearly 50 per cent by weight, but cacao butter removed from the bean in the manufacture of cocoa is added in the manufacture of some varieties. Hence the preparation of cocoa and chocolate are complementary processes. Both are rich in organic and inorganic constituents. The original bean, according to Whymper, in addition to oils and fats, contains carbohydrates, vegetable acids, acids of the pectose group, albuminoids or proteids, amides and various extractives. Inorganic constituents comprise numerous compounds of potassium, sodium, calcium, magnesium, iron, manganese and aluminum. In view of the increasing recognition of the importance of variety in a properly balanced diet and the necessity for the inclusion of a minute amount of certain substances of potent influence on health, it is probable that cocoa and chocolate have a food value that it would be difficult to overestimate.

of the product in special heated machines preparatory to the molding of the resultant milk chocolate.

Batch roasting is practiced. A large battery of motor-driven machines is in operation at the Ghirardelli plant, of standard design, each with a capacity of about 800 lb. The raw beans are delivered to an internal cylinder equipped with baffles and revolving during the process at a slow speed. A hollow shaft permits the sampling of the charge. Heat is supplied by an oil burner in the surrounding chamber, the hot air circulating around the cylinder. Discharge is effected by opening the door and giving the cylinder a few turns. The roasted beans are cooled in special cars, with perforated double bottoms, arranged for connection to an exhaust fan, which draws off the vapors and reduces the temperature to a point permitting the next step in the process to follow without delay, and without danger of fire or explosion in the separating machines.

Equipment used to crack the bean and separate the husk is provided with a magnetic device in the feed box to divert tramp iron. Cracking is done by toothed rolls; the separation of husk from bean is effected by air currents, and means is provided for the collection of dust. The cracker-separator machines in use at the Ghirardelli plant are of National Equipment design. Nibs and shells are first graded according to size, so that efficient separation can be made by adjustment of the air pressure in each compartment.

The cacao mill is similar to the machine used for the grinding of paint and ink; both are modifications of the well-known buhr mill, consisting essentially of two stone disks, one of which, the lower, is stationary, the other revolving at about 60 r.p.m. The faces of the disks are cut with radial grooves, the depressions being sharpened every 6 months by means of a special machine or pneumatic tool. The feed is delivered from an overhead bin to a central aperture, passing by gravity and centrifugal force to the periphery. The mills are steam heated, although a rise in temperature occurs during grinding, which facilitates the melting of the cacao butter in the nibs and produces a smooth liquor. High temperatures must be avoided, however, as overheating causes damage to flavor.

The mills in the Ghirardelli plant are in triple units, the liquor passing through all three in series before release. Feed, regulated according to the condition of the grinding stones, is observable through a glass cylinder. Most of the mills are driven in pairs by one 10-hp. motor.

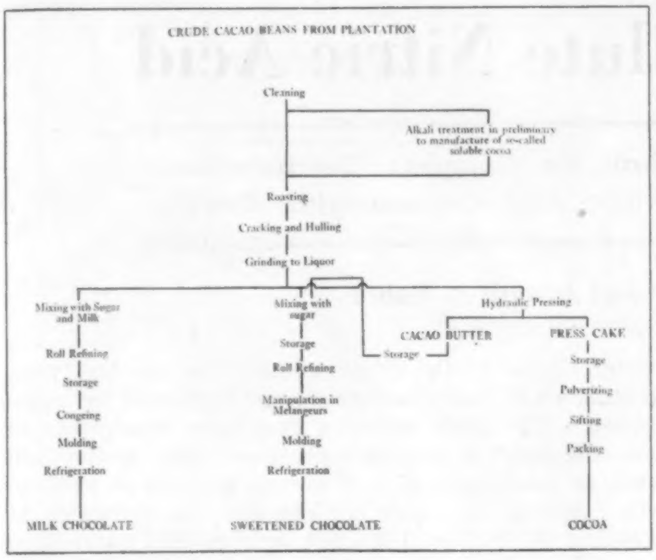
For the manufacture of cocoa, the fluid cacao from the mills is treated in hydraulic machines of special design, for the expression of the excess fat. A battery of Lehmann presses at the Ghirardelli plant is placed alongside the mills. The standard press consists essentially of a heavy cast-iron framework inclosing a nest of circular trays or receivers, the bottom of each of which is formed by a camel's hair mat. Into this receiver is distributed the cacao liquor by hose. When full, a second mat is placed on top, and the receiver is then pushed into the press. A steam-heated piston fits into each cup, and hydraulic pressure up to 6,000 lb. per square inch is used to express the oil, which passes to a steam-heated storage tank, from which it flows to the chocolate department.

Temperature control at each stage of the process is important. It has been seen that the cacao is in the form of a liquor as it leaves the mills, which are steam heated. This fluidity is made possible by the amount and the comparatively low melting point (between 28 and 35 deg. C.) of the cacao butter present. The roasted cacao nibs contain about 50 per cent of butter, sometimes more; chocolate may contain from 25 to 35 per cent, in addition to sugar, milk and flavoring; cocoa powder may contain from 20 to 30 per cent.

The cakes in the press are removed by hand, aided by a screw, but hydraulic release is planned. On the floor below they are broken into small pieces by means of a toothed-roll disintegrator, known as a forebreaker. A measured quantity of the product is then delivered to an edge-runner crusher, or melangeur, similar to a Chilean mill. This is equipped with scrapers of granite, which deflect the mass under the rollers. In some cases powdered sugar is added. The product, cocoa, is then screened, a fine-mesh fabric being used, the undersize going to the packing machines on the floor below, the oversize being returned to the mixers for further comminution.

The output from the Ghirardelli plant is partly in the form of sweetened chocolate, consisting of the original cacao liquor, plus cacao butter and sugar. This is sold to confectioners and makers of fancy products.

The mixing and preliminary grinding is done in what is known as a melangeur, which is an edge-runner,



Fundamental Steps in the Manufacture of Cocoa and Chocolate

granite mill, similar to the machine used for preparing the cocoa powder, but steam heated. Melangeurs are of two types: with rotating bed and stationary roll frame, and vice versa.

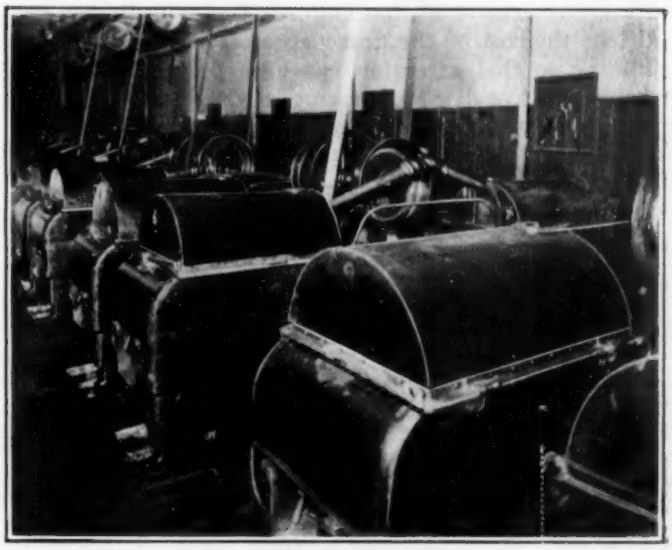
Treatment in the melangeur usually takes from 15 to 20 minutes. The product, in the form of a paste, is then transferred to a refiner, which consists essentially of several superimposed steel or granite rolls revolving in different directions and in contact with one another. The chocolate paste is delivered to a hopper above the lowest roll, passing between this and the second roll, above it and slightly to the side. This second roll is water cooled and revolves at about three times the speed of the lowest roll, thus insuring a combined crushing and grinding action, the product passing from one cylinder to the next in the form of a thin film. From the second roll the chocolate passes to the top roll, immediately above, which is also water cooled, but revolving at about three times the speed of the second roll. The combined effect of cooling and disintegration is the production of a flaky powder, which is scraped from the face of the top roll.

After sufficient fineness and evenness has been secured by roll refining, the product is "manipulated" in a melangeur. This insures the reversion of the chocolate to the fluid state, thus permitting molding. A mistaken idea exists in some quarters that during the processing of chocolate a mysterious "fatigue" may set in, indicated by a refusal of the mass to return to the fluid state on the application of heat and necessitating the addition of more cacao butter in the final melanging. As a matter of fact, the grinding of the solid constituent is solely responsible, the subdivision of particles to infinitesimally small proportions presenting an increased surface area and resulting in the absorption of the available fat.

After melanging, the chocolate mass is cooled to 50 deg. C., then placed in tin molds of the required shape, The molds and contents pass over a jigging table, whereby air bubbles are shaken out, and the paste is made to fill the receptacle completely. The next step in the process is refrigeration; the cacao butter sets, and the chocolate is easily separated from the mold.

The essential steps in the manufacture of sweetened milk chocolate are essentially similar to the foregoing, although processing is carried further. The mixing of cacao liquor, sugar and milk solids (from a vacuum pan) is effected in steam-heated stirring machines. Refining is practiced as in the manufacture of sweetened chocolate. The conche, also known as a taste-developing machine, takes the mixed product from the roll-refiners and reduces it to the mellowness and uniformity characteristic of the final article. The conches in use at the Ghirardelli plant each consist essentially of four mechanical mullers of granite, which are pushed to and fro in four inclosed chambers, each of which has a granite bottom. The operation of the conche is identical to the grinding of a sample of ore by buckboard and muller. The chocolate machine, however, is equipped with arrangements for heating, a comparatively high temperature being secured by steam to produce the characteristic flavor attained, which may be due to some extent to the carmelization of the sugar. The time of treatment in a conche averages 48 hours.

The Ghirardelli plant consumes about 30,000 lb. of sugar per day. In addition, about 1,800 gal. of whole milk is evaporated under vacuum and the product used



Oil Heated Roasters, Each With Motor Driven Inner Cylinder

in the manufacture of the milk chocolate. It is significant to note the absence of adulterant in any of the products, which indicates (1) good business; (2) the triumph of technology over trickery; (3) the benefit of pure-food laws of a nature unknown in Europe. Unsweetened chocolate is solely the roasted, ground and processed cacao bean, containing its original content of cacao butter. The sweetened and milk chocolates contain nothing more than the ground bean, to which is sometimes added excess butter expressed from the liquor used to make cocoa, plus refined sugar, pure whole milk from which the water has been evaporated, and flavoring.

Experimental Blast Furnace Blown In

A new experimental iron blast furnace, that embodies all the best features determined by observation of the performance of other furnaces constructed by Interior Department specialists, has been completed and blown in at the Minneapolis experiment station of the Bureau of Mines. It is expected that metallurgical studies now made possible will reveal valuable information relative to the production of spiegeliron from manganiferous iron ores, which cannot be smelted under present practice.

Concentrating Dilute Nitric Acid

Data That Furnish an Accurate Basis for Complete Determination of All Vapor-Liquid Equilibria in Nitric Acid Concentrating Towers

By Clifford D. Carpenter and Joseph A. Babor
Department of Chemistry, Columbia University

WITHIN recent years the concentrating of dilute nitric acid has become a major industrial operation, the necessity of recovering spent acids and of handling the dilute synthetic acids having given impetus to the development of suitable commercial methods. The investigations have followed two general lines: (1) Neutralization of the acid with soda ash or ammonia, followed by evaporation and treatment of the dry, solid nitrate with concentrated sulphuric acid; (2) fractional distillation. Under ordinary conditions the cost of the first method is economically prohibitive so that attention has been focused largely on the alternative distillation processes.

Because of the maximum boiling point exhibited by nitric acid solutions at 68 per cent concentration, it is not possible to obtain acid of greater strength by simple fractionation without the addition of a water binder such as sulphuric acid. In general no other water binder has been found to be more efficient than sulphuric acid, although many acids and salts have been tried.

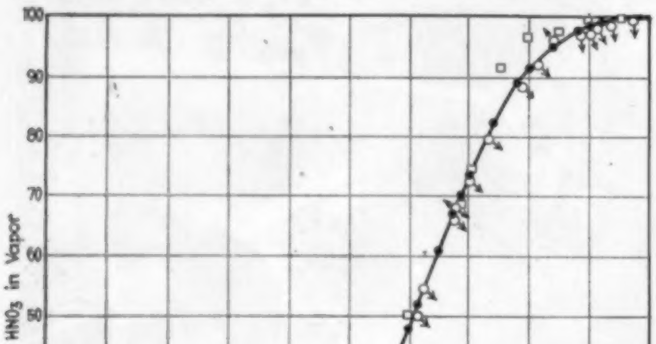


Fig. 1—Equilibrium Between Liquid and Vapor in Distilling HNO_3

Although some consideration has been given to concentrating dilute solutions of nitric acid by "preconcentrating" the dilute solutions to 55 or 65 per cent before adding sulphuric acid for the final so-called "superconcentrating," it has proved more practical to add the water binder to the dilute solution for the first fractionation and finally recover the sulphuric acid by evaporation. The main advances that have been made in the efficiency of this process have been mechanical, such as the construction of towers, methods of heating, etc. Among the most efficient are the processes of Pauling (U. S. Pat. 1,031,864, July 9, 1912) and Zeisberg (U. S. Pat. 1,292,948, Jan. 28, 1919).

A quotation of the first claim from each gives a general idea of the process. Pauling accomplishes the concentration by "passing aqueous nitric acid in admixture with a suitable dehydrating agent against a countercurrent of hot gaseous medium composed largely of steam, and so regulating the conditions of the operation that vapors of highly concentrated nitric acid are obtained, while the dehydrating agent takes up and retains substantially all the water of the aqueous nitric acid." Zeisberg's claims begin as follows: "The process which comprises subjecting nitric acid and sulphuric acid containing not less than 64 per cent of sulphuric acid and from 3 to 25 per cent of nitric acid to a hot gaseous current, carrying away the nitric acid vapors and condensing the same."

This general method has proved very efficient in the recovery of such dilute acids as (1) TNT spent acid, 4.5 per cent nitrogen acid content, (2) nitroglycerine spent

Table I—Vapor in Equilibrium With Boiling Nitric Solutions

	Composition of Vapor, Per Cent HNO_3				Composition of Vapor, Per Cent HNO_3		
Strength of Acid, Per Cent	Carpenter and Babor	Berl and Samtleben	Pascal	Strength of Acid, Per Cent	Carpenter and Babor	Berl and Samtleben	Pascal
5.00	0.048	.....	.....	62.50	54.60	.....	.....
10.00	0.200	.....	.....	62.64	.....	54.46	.....
12.50	0.35	.....	.....	65.00	60.80	.....	.....
13.45	.....	0.46	.....	65.18	.....	60.62	.....
15.00	0.55	.....	.....	67.43	.....	65.97	.....
17.50	0.75	.....	.....	67.50	66.80	.....	.....
20.00	1.05	.....	.....	67.89	.....	67.84	.....
20.58	.....	1.26	.....	68.00	(68.00)	68.00	.....
22.50	1.45	.....	.....	68.40	.....	.....	68.40
24.20	.....	.....	2.16	70.00	73.22	.....	.....
25.00	2.20	.....	.....	70.10	.....	.....	74.00
27.50	3.00	.....	.....	70.16	.....	72.56	.....
30.00	4.10	.....	.....	73.26	.....	79.63	.....
31.75	.....	4.94	.....	74.00	82.14	.....	.....
32.50	5.60	.....	.....	75.12	.....	.....	91.50
33.00	.....	.....	5.90	78.00	88.89	.....	.....
35.00	7.30	.....	.....	78.92	.....	88.54	.....
37.50	9.40	.....	.....	79.73	.....	.....	96.70
37.99	.....	9.20	.....	80.00	91.34	.....	.....
40.00	12.00	.....	.....	81.52	.....	92.08	.....
42.50	14.90	.....	.....	82.20	.....	92.87	.....
43.50	.....	14.86	.....	84.00	95.10	.....	.....
45.00	18.00	.....	.....	84.36	.....	95.72	.....
47.50	22.20	.....	.....	84.65	.....	.....	97.45
47.77	.....	21.77	.....	88.00	97.69	.....	.....
49.80	.....	.....	19.85	88.66	.....	97.16	.....
50.00	26.50	.....	.....	89.65	.....	.....	99.41
52.50	31.10	.....	.....	90.00	98.53	.....	.....
53.96	.....	33.51	.....	90.02	.....	97.34	.....
55.00	35.50	.....	.....	90.27	.....	97.68	.....
56.60	.....	39.37	.....	92.00	99.01	.....	.....
57.50	41.70	.....	.....	93.93	.....	98.52	.....
60.00	47.80	.....	50.02	95.38	.....	.....	99.63
61.47	.....	51.34	.....				

Abstracted from a paper presented at the Denver meeting of the American Institute of Chemical Engineers, July, 1924. For complete data on individual experiments and for methods of calculating results, reference should be made to the Institute paper, which was preprinted for the Denver meeting and will be published in the *Transactions*.

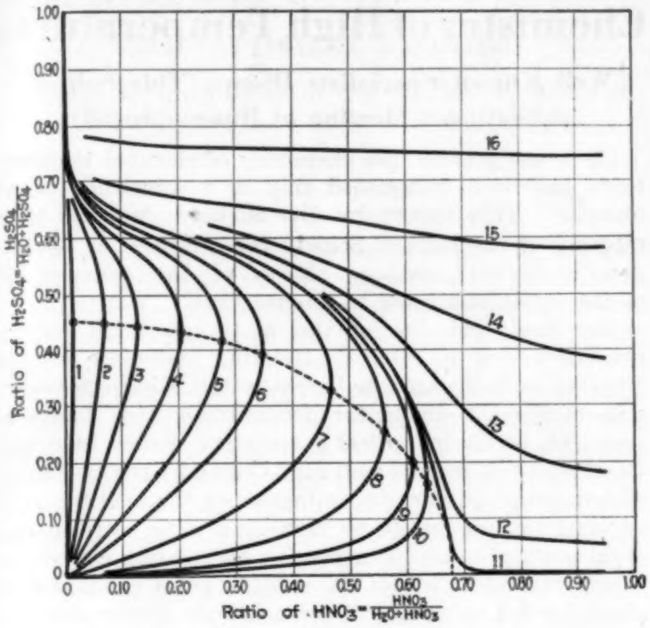


Fig. 2—Distillation of HNO_3 in Presence of H_2SO_4

acid, 8.5 per cent nitrogen acid content, (3) nitrocotton spent acid, 20 per cent nitrogen acid content, (4) synthetic acid from arc process, 35 per cent nitrogen acid content and (5) synthetic acid from ammonia process, 55 per cent nitrogen acid content.

As in the case of many industrial operations, great advances have been made by long experience with the industrial operation, yet back of the manipulations there are many steps involved which are not definitely known. In fact the efficiency of the present-day practice in concentrating dilute solutions of nitric acid seems to leave little opportunity for improvement. This is likely due to the fact that in a properly constructed tower conditions exist for nearly ideal fractionation.

Recently some careful experimental work has been carried out to learn the exact nature of the concentrating process. In 1919 Carpenter and some of his students carried out preliminary experiments in an attempt to develop a method by which the rate of concentrating of nitric acid by distillation could be carried out without fractionation. Later Babor and Carpenter (*Chem. & Met.*, 1922, vol. 26, p. 443) improved the preliminary work and developed a satisfactory method. While this work was in progress two papers, one by Pascal (*Ann. Chim.*, 1921, New Series, vol. 15, pp. 253, 290) and one by Berl and Samtleben (*Z. angew. Chem.*, 1922, vol. 35, p. 201) appeared and gave experimental data on the relation of the two phases of dilute nitric acid solutions. In a second paper (*Chem. & Met.*, 1922, vol. 27, p. 121) Carpenter and Babor corrected the experimental data in their first paper, extended the work and made a critical comparison between their work and that of Pascal and of Berl and Samtleben.

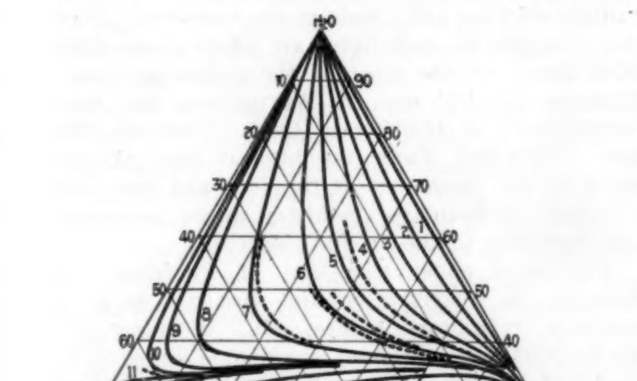


Fig. 3—Data of Fig. 2 Plotted on Triangular Co-ordinates
By turning this so that the H_2O-HNO_3 line is the base of the triangle, the general resemblance to Fig. 2 is quite evident

After considering the success of the method developed by Carpenter and Babor and the nature of the results obtained in the work on concentrating dilute nitric acid solutions, it seemed advisable to extend the work to acids of higher concentration and to study the ternary system nitric acid-sulphuric acid-water in the same manner.

Experimental Procedure

A quantity of nitric acid-water solution, or of nitric acid-sulphuric acid-water solution of known composition was weighed into a large Pyrex distilling flask at the beginning of each experiment, and put into the bath and attached as described in the previous papers by Carpenter and Babor referred to above. All experiments were carried on at atmospheric pressure. After the temperature had been slowly raised until steady distillation took place, approximately 50 gram portions of the distillate were collected in small weighed flasks. These fractions were analyzed by titrating with standard sodium hydroxide solution. Tests were made for sulphuric acid in the distillates and fractions of high nitric acid content were also analyzed for nitrous acid.

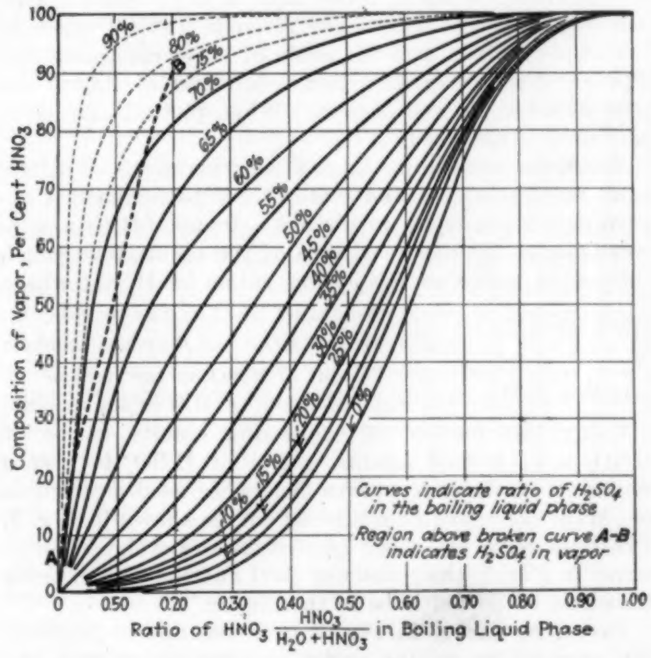


Fig. 4—Liquid-Vapor Equilibrium in Presence of H_2SO_4

Data on the System Nitric Acid-Water

Previous work on the binary system nitric acid-water was extended to include solutions with 70 to 92 per cent nitric acid. Four runs were made covering this range of concentrations and the results plotted on large co-

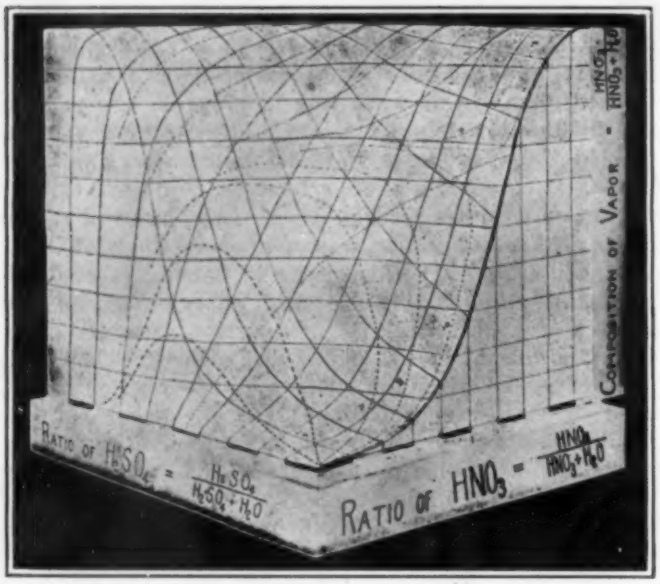


Fig. 5—Solid Model Showing Equilibrium Between Liquid and Vapor Phases

ordinate paper as per cent nitric acid in residue against per cent liquid distilled. From these curves it was possible to calculate the vapor in equilibrium with a given concentration of nitric acid in the residue. This was done and the results are given in Table I together with the previous data for acids of lower concentration. The results of Berl and Samtleben and of Pascal are also included for comparison. When plotted, the curve in Fig. 1 is obtained.

Solutions containing known concentrations of nitric acid, sulphuric acid and water were then distilled according to the same procedure. In all, fifty-six runs were made. The compositions of the residues were calculated as ratios of HNO_3 and ratios of H_2SO_4, where

$$\text{Ratio of } HNO_3 = \frac{\text{Weight of } HNO_3 \text{ in the residue}}{\text{Weight of } HNO_3 + H_2O \text{ in the residue}}$$

$$\text{Ratio of } H_2SO_4 = \frac{\text{Weight of } H_2SO_4 \text{ in the residue}}{\text{Weight of } H_2SO_4 + H_2O \text{ in the residue}}$$

Using this method of expressing results, ratios of HNO_3 were plotted against ratios of H_2SO_4 to give a series of overlapping curves that were used as a guide to obtain the smooth continuous curves shown in Fig. 2. The data have also been plotted in triangular co-ordinates in Fig. 3, the results of Berl and Samtleben being indicated as dotted lines in this figure.

From the curves in Fig. 2 it is possible to calculate the composition of the vapor in equilibrium with the boiling solutions. This has been done to give the series of curves in Fig. 4; and Figs 2 and 4 have been combined to give the solid model, Fig. 5.

This three-dimensional model shows:

1. The composition of the vapor or strength of the distillate obtained by distillation without fractionation of a mixture of nitric acid, sulphuric acid and water at any concentration of residue.
2. Change in residue composition on distillation.
3. The change in the composition of the vapor with continuous distillation.
4. Starting with a dilute nitric acid solution, it becomes a simple matter to determine the amount of sulphuric acid to be added in order to obtain a distillate of given strength.

The data therefore furnish an accurate basis for complete determination of all vapor-liquid equilibria in the acid towers used in concentrating nitric acid.

Chemistry of High Temperatures

Well Known Specialists Discuss This Subject at Göttingen Meeting of Bunsen Society

Up to the present, the chemistry of elevated temperatures has been understood only in a somewhat vague manner. This report by Dr. Richard Amberg of a meeting of the Bunsen Society recently held at Göttingen, deals with various phases of the behavior of matter when subjected to intense heat.

The first and one of the most important papers presented was by Dr. F. Henning, associate of the Physikalische-Technische Reichsanstalt, Charlottenburg, who outlined methods for determining high temperatures, especially by optical pyrometry. Below 1800 deg. Cent. the black body is well represented by the tantalum-ribbon lamp. A new determination of the melting point of platinum was made by melting a wire between two stout posts of brass by increasing the heating current so slowly that radiation at the melting point remains constant for 3-4 minutes. The black body temperature of the melting point of Pt is thus found to be 1575 deg. ± 2 deg. The melting point of W. was found to be 3370 deg. Cent. or 3640 deg. abs. temperature.

v. Wartenberg, of Danzig, formerly an assistant of Nernst, dealt with gas reactions at high temperatures. He gave a complete report of the present status of our knowledge on reactions above 1000 deg. Cent. Above this temperature the heat of volatilization generally becomes higher than chemical affinity; e.g. for carbides, it is very much higher than the heat of formation. This explains why extremely large quantities of energy are required to transform carbon into graphite. At the highest temperatures used in practice where silicates dissociate and where only a very limited number of chemical compounds, such as carbides, nitrides and oxides, are still possible, we are confronted with the difficulty of obtaining suitable material for containers. At still higher temperatures the "cold wall" can be obtained by using the explosion method in determining gas equilibria up to 2700 deg. Cent. Here the bomb of 10 liter capacity and up to 9 atmospheres pressure has proved very useful. Finally above 4000 deg. no chemical compound is any longer stable; all matter begins to radiate electron gas. Sodium gas needs only about 2000 deg. absolute to emit light, air needs about 4000 deg.-5000 deg. At the crest of the explosion wave for a thickness of 10^{-4} mm. v. Wartenberg has reached a temperature of 10,000 deg. Cent. Between 6000 deg. and 10,000 deg. Cent. the highest ever attained, we move in the chemistry of the free and pure electrons whereas our ordinary chemistry might be classified as the chemistry of the "bound" electrons.

The third paper was that of Professor Ruff of Breslau, on volatilization and dissociation of metals, carbides, refractory oxides, etc. Working in argon up to 2000 deg. has been a valuable asset. Crucibles made of alundum and heated in an electric helix of tungsten were useful up to 2050 deg. Crucibles of ZrO_2 when very slowly and gradually heated were serviceable at even higher temperatures. Containers of SiO_2 can be used up to 2200 deg.; SiC when used as material for crucible decomposes above 2500 deg. whereas 2200 deg. is generally given as the decomposition point.

W. Eitel of Königsberg gave a résumé of his own and other researches on silicates. The electrolysis of molten salts was discussed by Prof. R. Lorenz.

Getting Rid of Efflorescence on Gypsum Plaster

A Study of the Causes of the Surface Spotting of Plaster by Soluble Salts and Suggestions For Eliminating It

By F. C. Welch
Research Associate, Bureau of Standards

FREQUENTLY gypsum molds and plaster are rendered unsightly by the deposition of efflorescence on their surfaces. The present work was undertaken in order to obtain information that would aid in reducing these troublesome occurrences.

The factors influencing the appearance of efflorescence on bodies have been well established by previous investigators. They are, briefly, the solubility of the deposited salt, the amount and size of the particle of such salt, the temperature, the rate of drying of water on the surface of the body, and the amount of such water subject to evaporation. In general, efflorescence may be defined as the accumulation of salts upon the surface of a body, where they have been brought in solution and deposited upon the evaporation of water. Occasionally efflorescence is the result of the loss of water from certain crystalline salts.

Amounts of salts varying from ½ to 5 per cent by weight of the calcined gypsum were added to 50 grams of distilled water and 100 grams of unretarded calcined gypsum stirred into it. After thorough stirring, the plastic mixtures were poured into molds laid on smooth glass plates. When hardened, the casts were removed. Very smooth surfaces were obtained on the face next to the glass plates. The samples were then stored in the laboratory in such a manner that most of the evaporation would take place upon the smooth surfaces. Many of the salts added in these preliminary experiments might never be encountered as efflorescence on gypsum, but by their use information was obtained as to the formation of efflorescence.

Results of Preliminary Experiments

The results of these preliminary experiments showed that: (1) Efflorescence was obtained usually with the more soluble salts except where those salts were deliquescent. (2) Most of the efflorescence appeared within the first week. (3) The greatest amount of efflorescence was deposited on the edges and corners of the sample where evaporation was the greatest.

In Rohland's work on efflorescence he states that colloidal substances do not cause efflorescence. (Rohland, P., "Die eigentlich Ursache der Auswitterungen an Steinen und Mortel," *Zeitschrift für Chemie und Industrie der Kolloid,* 1911, vol. 8, p. 48.) Most inorganic colloids are very insoluble and deposits of these substances as efflorescence would not be expected. In this work no efflorescence of colloidal substances was noted, but where several fairly soluble colored organic colloids were used, such as dextrine and gum arabic, a slightly deeper color was noted at the surface of the material than at places farther away from the points of evaporation, showing the tendency of soluble colloids to come to the surface.

Often the sand used in the scratch and brown coats of a plaster contains soluble salts. It was desirable to know if such salts in the scratch and brown coat would cause serious efflorescence on the finish coat. Sanded coats containing soluble salts were made up as in the previous experiments and covered with a finish coat of neat calcined gypsum. Efflorescence on the finish coat was very noticeable.

Mixing Water Effects Porosity

The effect of the percentage of mixing water used on the amount of efflorescence obtained was then considered. Increasing percentages of mixing water increase the porosity of the material, also it increases the amount of water subject to evaporation. Efflorescence appeared first on the denser specimens and later on the more porous ones. The net result, however, was about the same, though the efflorescence on the porous specimens concentrated more on the edges and corners than that on the denser specimens.

Similar samples were exposed to air of different humidities. It was found that in saturated air there was no efflorescence, because of the fact that there was no evaporation. It was found also that in very dry air the efflorescence was less than in the atmosphere of the room, due no doubt to the very rapid evaporation of the water.

Samples of neat gypsum exposed to air having a vapor pressure below the dissociation pressure of gypsum became powdery on the surface and very punky; crystals of gypsum on being treated in like manner showed a powdery deposit on their surfaces, because of loss of water of crystallization. Likewise, samples of gypsum containing the deliquescent salts calcium and magnesium chlorides had deposits of these salts on the surface, thus showing the same effect.

Percolation Causes Efflorescence

Several samples made up as before were placed in water so that the water percolated through the material and evaporated upon the surface. Efflorescence on all samples was increased greatly; many samples showing no efflorescence upon the evaporation of the mixing water showed considerable efflorescence upon this treatment. Gypsum was deposited as efflorescence when treated as above showing that percolation has a decided effect in plasters of this sort.

In order to determine the compositions of the efflorescence obtained, a qualitative analysis was made of practically all the samples. In nearly every instance the soluble salt added to the mixing water was found to be deposited as efflorescence, but analyses of the efflorescence on those specimens containing MgO and $MgCl_2$, which were allowed to stand in water, showed it was magnesium sulphate.

The principle applied in stopping efflorescence on clay ware and brick is that of precipitating out the troublesome ingredient as some less soluble substance. As the trouble is usually due to sulphates, the substances added are compounds of barium, $BaCO_3$, BaF_2, $BaCl_2$ or $Ba(OH)_2$. In the case at hand the addition of hydrated lime precipitated out many of the metallic sulphates as calcium sulphate and insoluble hydroxides. $Ca(OH)_2$ proved very effective in stopping efflorescence of $FeSO_4$, $Al_2(SO_4)_3$, $ZnSO_4.7H_2O$, $(NH_4)_2SO_4$ and $CuSO_4.5H_2O$. As all finish coats of plaster contain a high percentage of $Ca(OH)_2$, efflorescence of these soluble salts from the brown or scratch coat would be prevented. $Ca(OH)_2$ was added in excess in every instance to decrease the amount of salt in solution. However, it had apparently

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no effect in preventing efflorescence of the chlorides and sulphates of potassium and sodium.

As sodium and potassium form very few insoluble compounds, the problem of stopping efflorescence of salts of these elements was attacked from a different angle. It was thought that efflorescence of compounds of sodium or potassium might be reduced by the addition of some colloidal substance that would prevent the deposition of these salts on the surface, either by lowering their rates of diffusion or by the adsorption of the salt in question. Dextrine, gum arabic and glycerine reduced considerably efflorescence of KCl, K_2SO_4, NaCl, $Na_2SO_4.10H_2O$ and $MgSO_4.7H_2O$. Other colloids such as starch and gluten did not appear to stop appreciably efflorescence of the above compounds.

Dextrine and gum arabic retard the time of set of gypsum slightly and their effect on a mixture of lime and gypsum such as is used for a finish coat of plaster is serious. One per cent of either substance will retard the set of such a mixture considerably and should not be used. Sizing the surface of the wall with a solution of gum arabic after the wall has dried out will reduce the efflorescence of these troublesome salts.

Painting or varnishing a surface will prevent efflorescence resulting from condensation and evaporation upon the surface of moisture in the air. However, where water continually seeps through the plaster unsightly spots are formed on the paint.

CONCLUSIONS

1. Efflorescence on gypsum may be from soluble salts in the mixing water, sand or calcined material itself, or a soluble salt formed by the interaction of an insoluble or deliquescent salt with the gypsum. Fairly insoluble compounds such as gypsum and calcium carbonate may be deposited as efflorescence if water percolates through the material continuously or if water is condensed and evaporated upon the surface of the material repeatedly.
2. Efflorescence of soluble salts in wall plaster because of the evaporation on the surface of the plaster of small amounts of water is usually prevented by lime added to the plaster at the mill or by lime used in the finish coat.
3. Efflorescence on gypsum casts and moldings may be reduced considerably by adding to the mixing water ½ per cent of dextrine or gum arabic.
4. In garages, factories, etc., where considerable condensation is apt to take place upon the walls and ceilings, efflorescence may be prevented by closing the pores of the plaster by either sizing or painting.
5. Where efflorescence is the result of the continued percolation of water through plaster from leaky pipes, defective flashing, etc., it can be prevented only by stopping the source of such water.

Eliminating Variables in Dye Tests

Commercial dyes are so complex in nature and so variable that the ordinary methods of chemical analysis are not very satisfactory for their evaluation. The industries which manufacture or use dyestuffs almost always resort to a practical method of test in which laboratory dyeings of the samples in question are compared visually with dyeings of a standard sample.

The Bureau of Standards, Department of Commerce, has suggested a method of eliminating the variables which enter into laboratory dyeing. It is proposed to dye the fiber cut into very short lengths in a closed dye bath equipped with a reflux condenser to maintain the volume constant and an agitator in the bath to give perfect mixing. The dye bath is surrounded by an outer jacket containing a boiling liquid by means of which the temperature is kept constant. The dyeings made are compared under standard conditions of illumination.

An Ingenious Chemical Process Used in

Purification of Cane Juice

The So-Called "Superdefecation" of Cane Juice Is Attracting Considerable Favorable Attention—It Was Based on Laboratory Studies

By William D. Horne
Consulting Chemist, Yonkers, N. Y.

TO BOTH the raw sugar manufacturer and the refiner the best possible defecation is a very important matter. Coming as it does so near the beginning of each process, it is fraught with great possibilities to aid or to hinder the following steps in the operation. This is particularly important in raw sugar making, for any impurities that are left in the raw juice, through incomplete defecation, not only drag along through the entire process of raw sugar making but also make themselves felt to disadvantage in refining the sugar as well.

Of all the agents ever used in defecating raw cane juice, lime has proved the best, and its universal application is because of its ability to neutralize the acids of the juice, to precipitate the phosphatic constituents and to throw down a considerable quantity of the organic non-sugars that cane juice in the raw state always contains.

This action is so energetic that care has to be taken to prevent the addition of too much lime, for this, combined with high temperatures continued for long periods, will cause destruction of reducing sugars, with the production of dark colored, melassigenic substances that are a great detriment to manufacturing operations and products.

EXACT AMOUNT OF LIME IMPORTANT

On the other hand, it is equally important not to add too little lime, for such a procedure is followed by acidity of juice with probable inversion of sucrose, and such an incomplete separation of impurities naturally present in the juice as seriously to impair the yield of sugar in the course of manufacture.

The difficulty of meeting these opposing requirements has been so great that it is safe to say that usually a wrong amount of lime has been added, either not enough to eliminate all of the precipitable bodies, leaving objectionable impurities in the juice or else an excessive amount, leaving the juice too alkaline, and dark colored from decomposition products, and overloading juice, sugars and molasses alike with excessive amounts of ash.

Efforts made many years ago to meet this situation by adding enough lime to produce complete precipitation and then neutralizing the excess of lime with acid bodies failed, for the reason that the precipitate formed in the highly alkaline solution largely redissolved when the alkalinity was reduced.

Some years ago the writer was led to inquire into this situation and found that after lime has been added to a cane juice sufficiently to neutralize the acids present, as shown by delicate litmus paper, there is continued chemical activity on the addition of more lime through a considerable range, during which time the

lime continues to precipitate more and more of the gummy constituents of sap before the juice finally becomes alkaline to phenol phthalein paper. Only a part of this range between alkalinity to litmus and alkalinity to phenol phthalein is accompanied by phenomena of precipitation, and it is useless to add any more lime after the last precipitable matter has been thrown out of solution.

This point of complete precipitation was found to be generally from one-third to two-thirds of the way between alkalinity to litmus and alkalinity to phenol phthalein. Its exact point can be readily determined by adding dilute milk of lime, made by grinding 1 gram of factory lime in 100 c.c. of water, in small doses of 1 c.c. or less at a time to a 100 c.c. portion of the juice to be tested, boiling, filtering and testing the filtrate with further small quantities of the dilute lime.

In Cuba about 2 c.c. of such lime will commonly effect neutrality to litmus, and about twice that amount will yield an incipient alkaline reaction to phenol phthalein. The point of complete precipitation will be found to be between these two.

Phosphoric Acid Used to Remove Lime

The next step after coagulating and settling the maximum amount of impurities by the proper degree of liming, heating, settling and decanting is to remove the excessive lime from solution before it does any damage through its action on invert sugar and other constituents of the juice during the long periods of heating in the evaporators and vacuum pans. A thorough consideration of the subject and long experimentation indicated that phosphoric oxide in some form was the best agent for this part of the process, and gradually there was evolved a new, special reagent, effective and yet cheap, for reducing the alkalinity, precipitating the lime and removing iron and other bases such as magnesia and alumina from the solution. This reagent, when heated with the juice decanted from the lime treatment, causes the rapid formation of a slight flocculent precipitate, which rapidly settles to the bottom, carrying with it the bagacillo and other suspended particles, raising the purity and considerably lightening the color of the solution. The second precipitate, being neutral, can be added to the first or alkaline precipitate without acting on it chemically, and the two can be filter-pressed together, giving dry hard cakes.

Press Cake Makes Good Fertilizer

In cases where the first precipitate is returned to the mills, the second can be filter-pressed separately. In either event its richness in phosphoric oxide makes it an ideal fertilizer and as the P_2O_5 exists in it almost entirely in a form immediately available as plant food, it is advisable to return it to the fields. The amount used in defecation is only about one-tenth to one-thirteenth of the amount commonly recommended for use as fertilizer for an equivalent amount of cane, it costs scarcely more per pound of phosphoric oxide than a cheap fertilizer and every dollar's worth is claimed by agricultural authorities to produce several times as much value in the increase in cane yield. Its possible use therefore is very extensive.

This process of superdefecation, protected by United States and foreign patents, has now been carefully worked out in its many practical details through applying it to all the juice of a large Cuban mill during the last week of a campaign and later through applying it to all the mill juice of another central during the entire final month of the campaign. During these experimental runs the various precise details of operation were worked out and many notable results obtained.

Superdefecated Juice Is Very Clean

The superdefecated juice was far cleaner than ever before and showed an extra degree rise in purity, the meladura was clear and deposited no sediment, the sugars boiled very freely and the first sugars were made at 99 deg. These were sold for direct consumption at a good profit. Washing with 3 gal. of water on a full charge in a 40-in. centrifugal raised the purity to 99.86 deg. The second sugars, carrying practically all the molasses of the first, were turned out at 96+ and like the first sugars were noticeably more brilliant than usual. The analyses of juice and meladura indicated a removal of more than 39 per cent of the ash, no inversion of sucrose and no increased destruction of glucose.

The greater cleanliness of the juice was apparent in the diminished amount of incrustation in the quadruple effects, which were able to boil to a heavier density than usual at the end of the week. They were easily cleaned out and the treatment with caustic soda, always necessary before, was abandoned as now unnecessary. The slightly greater alkalinity of the defecation gave a more abundant precipitate, which increased the filter-press mud by about 13 per cent. Only a small percentage of this was constituted by the reagents added. The settling was slower, because of greater alkalinity. The second precipitation takes place very quickly and requires about 60 per cent as much settling capacity as the defecation system that is ordinarily used in the industry.

The ash gradually fell in the final molasses from 11.53 per cent at the beginning of the month's run to 6.26 per cent at the end of the run. The value of molasses produced also fell from 7.76 gal. per bag of sugar produced at the beginning to 6.55 gal. at the end of the run. This reduction of ash took place in spite of a constantly rising ash content in the juice during the entire month.

Equipment Is Large Item of Cost

The cost of operating the process consists principally of equipment for settling about 60 per cent more than usual, with pumps, etc., to move the solutions, and the cost of chemicals, which in the cases mentioned came to about 2.3c. a ton of dilute juice handled, from which about 1.3c. can be deducted for the manurial value of the press cake from the second defecation. To this should be added a small fraction for freight on chemicals.

The process can be used equally well with either intermittent settlers, such as the old-fashioned blowups, or with any of the continuous settlers such as the Deming, Dorr or Ruckstuhl. Where the defecation mud is returned to the mills, this process is also particularly well adapted, for by carrying a slightly greater alkalinity of juice a more complete separation of impurities is effected and the character of the mud improved for filtering out in the bagasse. After the juice is thus cleared of its precipitate, it is only necessary to treat it with the proper chemicals and pass it through one additional settler of about 60 per cent the capacity of the first settler, and a juice of highest quality will be obtained.

What is Good Magnesium Oxychloride Cement?

Effects of Adding Free Lime and Calcium Carbonate Studied and Causes of Weakening of Cement in Case of Former Investigated

By H. L. Olin and Ben H. Peterson
State University of Iowa

THE effect of the presence of lime in magnesia cements has been studied by Rourke (see Univ. Wis. Bulletin 879) and more recently by Seaton and his co-workers (see *Chem. & Met.*, 1921, vol. 25, p. 270). The latter points out clearly the difference between "water-soluble" lime as determined by the Duschak method and "active lime" as measured by the amount removed by extraction with magnesium chloride solution. He shows by comparing the results of physical tests made on various magnesites carrying active lime up to 4 per cent that the amount of this constituent is not definitely indicative of the quality of the cement and concludes that only when it is present in large quantity need it be regarded with suspicion.

Previous to the appearance of Seaton's paper an investigation covering not only the effects of free lime but of other oxides as well was in progress in our laboratory. Variation in lime content, however, was brought about by the addition of calcium oxide of known purity and thus the range of difference was extended beyond the limits encountered in commercial samples such as were used by Seaton.

Six magnesites of the composition given in Table I were selected as base materials. Water-soluble lime was determined according to Duschak inasmuch as the alternative method had not yet been published. In recognition of the fact that the latter gives uniformly higher results, we must assign the so-called active lime a value—indefinite but bounded by narrow limits—somewhere between those for water-soluble and total lime as tabulated. In the case of thirty magnesites examined by Seaton with a mean total lime content of 3.81 per cent mean values for active lime were 1.94 per cent and 0.57 per cent by the magnesium chloride and water solubility methods respectively.

Table I—Composition of Magnesite Cements

Sample	Specific Gravity	Loss on Ignition	Insoluble Matter	Water-Soluble CaO	Al_2O_3	Fe_2O_3	Total MgO
A	1.845	4.62	10.93	1.50	4.67	4.95	74.33
B	1.811	4.96	11.40	0.80	3.40	4.40	75.83
C	1.754	3.41	6.40	0.81	4.60	5.02	80.75
D	1.803	4.32	9.62	0.93	4.72	4.53	75.62
E	1.816	3.97	8.97	0.89	3.97	4.47	79.31
F	1.837	4.08	6.59	1.22	4.02	4.69	81.36

These cements when made up into test pieces of standard mix—one part magnesite, two parts silex and five parts sand and brought to the proper consistency with 22 deg. Bé. magnesium chloride solution—showed the resistances as measured with standard testing machines as given in Table II.

Table II—Tensile and Cross Breaking Strengths, Standard Mix

Magnesite Sample	Tensile Strength			Modulus of Rupture		
	7 Days	14 Days	28 Days	7 Days	14 Days	28 Days
A	625	632	754	1,252	1,623	1,741
B	475	568	519	1,292	1,246	1,287
C	638	605	654	1,101	1,462	1,456
D	...	...	...	1,200	1,890	1,818
E	628	663	709	1,165	1,492	1,760
F	720	800	814	1,288	1,535	1,610

In harmony with the results of other investigators, our tests showed no bad effects on the addition of 120-mesh calcium carbonate up to 6 per cent of the weight of the magnesite. Freshly prepared oxides of iron and alumina, likewise, up to 4 per cent of the weight of the magnesite made no apparent reduction in tensile strength, although the modulus of rupture was slightly lowered. The weakening effect of free lime added in the form of the oxide of known purity was, on the other hand, decidedly marked, as may be seen by reference to Table III.

Table III—Effect of Addition of Lime to Magnesia Cements

Magnesite No.	Lime Added, Per Cent	Tensile Strength			Modulus of Rupture		
		7 Days	14 Days	28 Days	7 Days	14 Days	28 Days
C	0	638	605	654	1,101	1,462	1,456
C	1	570	707	699	1,006	1,517	1,650
C	2	338	575	586	1,092	1,243	1,444
C	4	479	573	747	962	1,386	1,309
C	10	395	430	400	690	960	900
D	0	...	...	...	1,200	1,890	1,818
D	3	...	...	...	1,160	1,470	1,628
D	6	...	...	...	1,170	1,218	1,250
D	9	...	...	...	945	970	1,065
D	12	...	...	...	975	1,031	1,100
E	0	628	663	709	1,165	1,493	1,760
E	3	603	650	680	1,070	1,410	1,600
E	6	537	600	605	1,065	1,317	1,430
E	9	550	590	580	928	1,017	1,129
E	12	360	405	502	803	932	1,020
F	0	720	800	814	1,288	1,535	1,610
F	3	639	722	765	1,225	1,425	1,560
F	6	597	598	630	1,025	1,215	1,392
F	9	485	500	590	908	1,029	1,190
F	12	378	428	450	760	908	1,002

Six or more individual samples were taken for each test, the mean results only being given in the table. Decrease in strength is practically a straight line function of lime content for each cement studied as shown by the graph in Fig. 1.

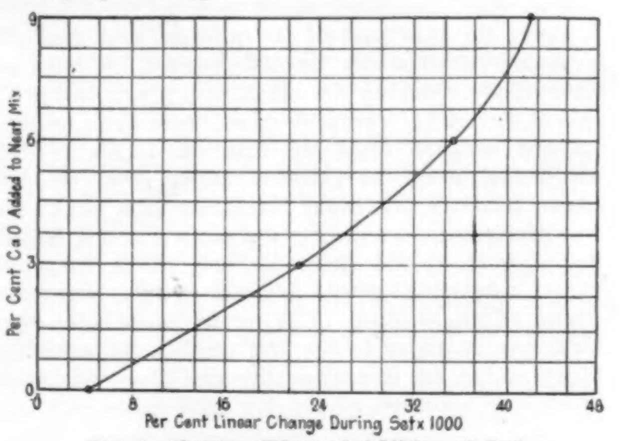


Fig. 1—Showing Effect of Addition of CaO

Table IV gives coefficients of expansion of various test pieces for moderate ranges in temperature, and shows conclusively that high lime content has no effect upon temperature-volume change. Calculated to the basis of a 10-ft. wall which represents a moderate extreme of stucco space the increase in length for a temperature rise from 0 to 100 deg. F. would be only 0.09 in.

Table IV—Expansion with Change of Temperature

Magnesite D	Composition	Thermal Range, Deg. C.	Coef. of Expansion
1	Standard mix	41.5 to 24	0.0000175
2	Standard mix	44 to 27	0.0000141
3	Standard mix	36 to 28	0.0000150
4	Standard mix	40 to 27	0.0000154
5	Standard mix	44 to 4	0.0000140
6	3% CaO added	48 to 29	0.0000147
7	6% CaO added	51 to 35	0.0000147
8	6% CaO added	50 to 34	0.0000150
9	9% CaO added	43 to 22	0.0000150
10	9% CaO added	45 to 17	0.0000125
		Mean	0.00001506

These measurements were made with an instrument designed by the junior author, which consists essentially of a microscope equipped with a standardized micrometer eye-piece divided into 100 divisions, so mounted that the relative change of position of a cross hair marked on a glass plate inserted in the test bar may be accurately gauged.

The results of a series of measurements of change of length during set throw much light on the role played by free lime in the cracking and failure of magnesite stucco. The test bars were made up as before and placed immediately under the microscope, the high power of which made possible extremely delicate readings. Observations were made at intervals of 2 hours

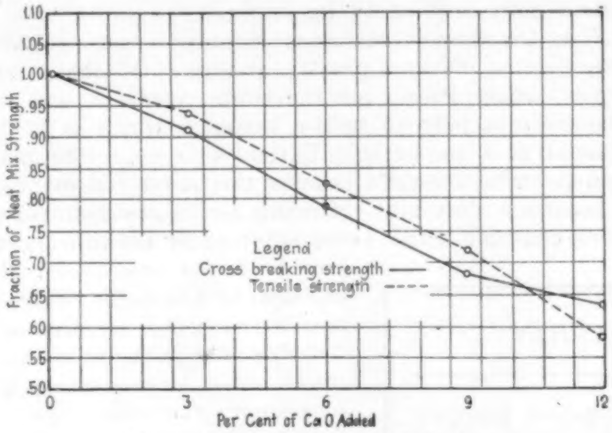


Fig. 2—Strength Versus CaO Content

for a period of 12 hours and then twice daily for 2 days. The contraction was rapid at the beginning of the set and nearly the whole of the change took place in the first 6 hours.

Table V—Change of Length During Set

Sample	Composition	Length of Bar, Mm.	Linear Change, Mm.	Per Cent Linear Change
1	Standard Mix	500	—0.020	—0.004
2	Standard mix	500	—0.015	—0.003
3	Standard mix	500	—0.0175	—0.0035
4	3% CaO added	500	—0.100	—0.020
5	3% CaO added	500	—0.110	—0.022
6	6% CaO added	500	—0.180	—0.036
7	6% CaO added	500	—0.170	—0.034
8	9% CaO added	500	—0.205	—0.043

It may be seen that the addition of 6 per cent of lime increases the setting shrinkage tenfold. These results were confirmed, qualitatively, in a series of tests wherein pats ranging in composition from the standard mix to those with 12 per cent lime added were allowed to set until thoroughly hard. Failures due to cracking were observed invariably with lime contents above 6 per cent; with decreasing percentages sound pats were obtained.

Absorption Tests

In a supplementary series of tests we determined the effect of variation of mix on the apparent water absorption of the cured cement as well as of the loss by solution. It may be readily seen that such effects have an important bearing on the resistance of this material to weathering when used for exterior finish. Dry thoroughly cured pats of the compositions shown in Table VI were used.

Three samples of each mix were weighed and placed in water at laboratory temperature; at the time indicated they were removed, wiped dry and quickly weighed. When the loss in weight became nearly constant the samples were dried and total loss by solution was calculated. Results are shown graphically in Fig. 3. Most conspicuous is the relatively high loss by solution in mixes of high silex content.

Table VI—Composition of Absorption Test Pats

	MgO	Silex	Sand	Tensile Strength
B_6	15.0	25.0	60.0	832
B_7	12.5	27.5	60.0	733
P_8	12.5	32.5	55.0	882
E_9	12.5	37.5	50.0	749

Summary

The results of other investigators on the negative effect of the presence of inert calcium carbonate in

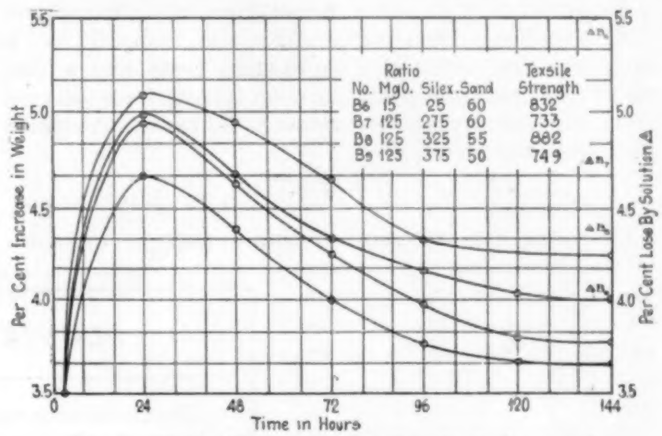


Fig. 3—Water Absorbed When Sample Is Immersed

magnesia cement mixtures were confirmed. Active lime, on the other hand, is positively deleterious in proportion to the amount present, the weakening effect being due not to a rise in the temperature expansion co-efficient after set but to a large increase in volume change during the setting process.

The effect of variation in mix on water solubility of the aged cement is pointed out.

Colored Fiber Standards Prepared

A set of colored plates has been prepared by the Bureau of Standards illustrating eight paper fiber compositions as seen under the miscroscope. They are intended to serve as reference standards for use in the identification of paper fibers and in the estimation of the fiber composition of the paper.

The fibers covered by the set are rag (cotton and linen), sulphite (coniferous), soda (deciduous), groundwood (coniferous), sulphate (deciduous), jute, manila, and esparto. Special stains were used to bring out the fiber markings. The fibers were drawn with the aid of a camera lucida and the drawings were painted with water colors, being matched by daylight with the actual fibers as seen under a microscope.

These drawings are expected to prove of great value to laboratory workers in the microanalysis of paper, as the colored micrographs come much closer than photomicrographs do to representing the fibers as they actually look when seen through the microscope. They show not only the form but the color reactions as well.

These plates are published in Technologic Paper No. 250 of the Bureau entitled "Pulp and Paper Fiber Composition Standards." Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15c. cash.

Crushing and Grinding Costs

An Analysis of the Cost of the Various Types of Equipment for Disintegrating Materials and Their Installation and Operation

By Tyler Fuwa
Research Associate, Massachusetts Institute of Technology

THE first part of this article is given over to a description of the various types of crushing and grinding machinery. This is followed by a graphical presentation of equipment costs and a discussion of operating costs based on typical cases selected from industrial practice in the grinding of phosphate rock and limestone.

Classification and Description of Machines

Crushing and grinding machines may be classified into three major groups:

(1) Preliminary, or coarse crushers, which are designed to take a feed up to 60 in., giving a product of 1½ in. or finer.

(2) Fine crushers, which handle a feed of about 1½ in. and give a product of ¼ to ⅛ in.

(3) Fine pulverizers, which take a feed as large as 1 in., but usually ¼ in. or less, and reduce to 100 mesh, or about 90 per cent through 200 mesh.

Some engineers introduce a fourth class called intermediate crushers, which are often useful in reducing feeds of 6 to 1½ in. to about ¼ in.

Another system of classification is possible, based on the mechanism of rock subdivision. For example, there are machines that crush by pressure, such as the jaw crusher; others that crush by impact mainly, and still another class where the material is sheared, or torn apart.

The selection of crushing machinery depends, therefore, largely upon two factors: first, the range of reduction in size, and second, the physical properties of the material to be reduced. The more important physical properties to be taken into consideration are those of hardness, mechanical structure and moisture content.

Preliminary Crushers—The jaw crusher is perhaps the best known machine of this class. Crushing action is obtained by the reciprocation of a pivoted jaw against a fixed jaw. These machines are characterized by mechanical simplicity and ruggedness of construction.

For handling large quantities of material, the gyratory crusher is preferable on account of its lower power consumption. In this popular type of machine, the rock is broken by the action of a conical member rotating eccentrically against a fixed external funnel-shaped member. The product of the gyratory crusher is uniform as compared with that of the jaw crusher. Both machines handle feeds as large as 60 in. and deliver a product of 1½ in. or finer.

Fine Crushers—This class includes crushing rolls, rotary crushers and gravity stamps. Of these machines, crushing rolls are the most important, and are adapted especially to brittle material which is to be reduced to ⅛ in. or so. Beyond this point the fines tend to choke the rolls, causing the power consumption to become unduly high. Crushing rolls are mounted in pairs, crushing action being obtained by the convergent travel of the roll faces, the material at first being "nipped" and later crushed by pressure. The diameter of the rolls determines, to a large degree, the maximum allowable size of feed, while the space between them regulates the maximum size of product.

Rotary crushers are designed for the reduction of brittle material of medium hardness, such as coal. In this mill a fluted conical member rotates within a grooved and fixed grinding ring, the size of product being regulated by the clearance between the grinding elements.

Gravity stamps are a special type of impact crusher used almost exclusively in the mining industry for the reduction of gold-bearing quartz. Stamps are very wasteful of power, and the product from them is not at all uniform. Crushing is effected by the impact of falling hammers, water being used to sluice out the product.

Fine Pulverizers—The important machines in this class are ball mills, tube mills, rod mills, centrifugal roll mills and "impact" or hammer bar pulverizers. Other more specialized types include buhr stone mills and edge runners.

Ball mills, because of their simplicity of construction and comparatively low maintenance cost, are being used in many divergent industries with marked success. Reduction is accomplished by the impact and shear caused by the contact of steel balls or flint pebbles upon one another, and is a function of many factors, most of which are easily controlled. Ball mills consist of a closed cylindrical shell, suitably lined and containing the charge of balls. The slow rotation of the cylinder upon its axis produces the required tumbling action.

In principle, tube mills are simply elongated ball mills. This design makes possible a product of extreme

DISINTEGRATION

In purchasing crushing and grinding equipment there are many factors that should be considered. Some of these are significant in causing operating costs to mount and their relative importance changes radically with different installations. A good perspective of this may be obtained from this study by Mr. Fuwa. It is a continuation of the series of which two have already been published, dealing with the economics of chemical engineering unit processes.

A UNIT PROCESS OF CHEMICAL ENGINEERING

fineness. In general, it may be said that ball mills are used for relatively coarse grinding and tube mills for the finer work up to 200 mesh or so.

Another important modification of the ball mill is the rod mill, in which a charge of rods the length of the mill constitutes the grinding element. This mill, as well as ball and tube mills, operates to best advantage on either a very dry feed or on one that is pulpy in character and contains a large proportion of water.

The fine grinding of soft and moderately hard materials of a friable nature is accomplished very efficiently by centrifugal roll mills. In this general type of mill one member, consisting of one or more rolls attached to hinged spider arms, rotates over the inside surface of a grinding ring, reduction being accomplished by a combination of pressure and shear. There are at least six mills operating on the ring roll or ring and ball principle, the distinguishing features being the method of feeding and of separating out the product.

Impact or hammer-bar pulverizers consist of a series of rotating hammers or bars swinging within a housing, the bottom part of which is a discharge grating set to the desired fineness of product. With these machines

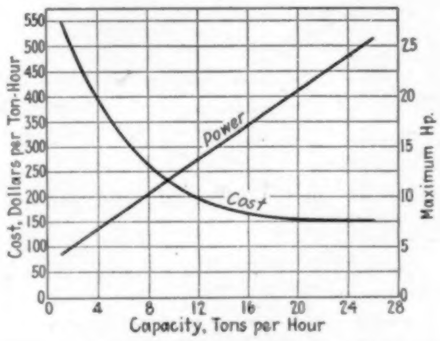


Fig. 1—Cost of Jaw Crushers
Based on approximate capacity on hard limestone with feed of 6 to 14 in. and product of 1½ to 3½ in.

it is possible to handle a wide range of materials varying in hardness and mechanical structure from limestone to wood chips.

Cost of Crushing and Grinding Machinery

For the most part, it is difficult to express the cost of crushing and grinding machinery as a function of any dimensional factor. There are, however, a number of common materials such as limestone, phosphate rock and coal that can be used as a basis of capacity, and therefore of cost, when expressed as dollars per ton capacity per hour.

The cost of various types of machines can be expressed graphically. Figs. 1 and 2 deal with the cost of preliminary crushers of both the jaw and gyratory types, the basis of capacity being hard limestone crushed between definite limits. It is realized at the outset that certain important factors affecting capacity, such as moisture content, hardness and mechanical structure, must be taken into consideration in every estimate of performance. For this reason only common materials have been chosen as standards, and in every case the capacity figures given are the conservative estimates of equipment manufacturers.

The costs as given for jaw and gyratory crushers are not exactly comparable, since the range of capacity differs. Machines of the gyratory type operate to best advantage when handling large tonnages and in a continuous manner. Jaw crushers, on the other hand, are indicated where operation is intermittent and on a smaller scale. For capacities of less than 10 tons an hour the jaw crusher is usually to be preferred, on account of the smaller initial investment required.

For purposes of intermediate and fine crushing, single and multiple rolls, rotary fine crushers and swing

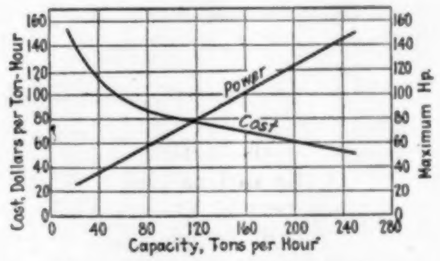


Fig. 2—Cost of Gyratory Breakers
Based on approximate capacity on hard limestone with feed of 6 to 14 in. and product of 1½ to 3½ in.

sledge mills are commonly used. The cost of these machines is given in Figs. 3 and 4. Here again costs are expressed on the basis of capacity when crushing fairly definite materials—that is, bituminous coal and limestone.

The cost of two distinct types of fine pulverizing machines is given in Figs. 5 and 6. Fig. 5 shows the cost of ball mills plotted as a function of the grinding capacity. Tube mills will be in about the same range of cost, as they are merely elongated ball mills. Special rod mills of very heavy construction built for the grinding of hard material cost twice as much as the usual type of ball mill. Good linings made of special hardened steels may be had at about 15 to 20 per cent of the initial cost of the mill. Forged steel balls cost about $6 per 100 lb., and flint pebbles for grinding cost $1.50 per 100 lb.

Another markedly successful type of fine pulverizing machine is the ring roll mill in its various modifications. Ring roll mills, as will be seen from Fig. 6, are the most expensive type of grinding machine in common use. However, the cost as expressed in the curve includes a separating device for closed circuit grinding, and a feeding mechanism as well. Owing to the

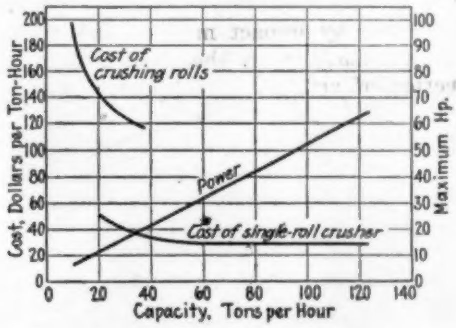


Fig. 3—Cost of Crushing Rolls
Basis: Approximate capacity on medium bituminous coal. Feed: 6 in. or less. Product: 1 in. or less.

high grinding efficiency of these mills, the over-all operating cost per ton may be very low, thus amply justifying the initial investment required.

Every crushing mill requires auxiliary machinery for the transportation of materials and for screening. Very often a layout will include elevators, feeding

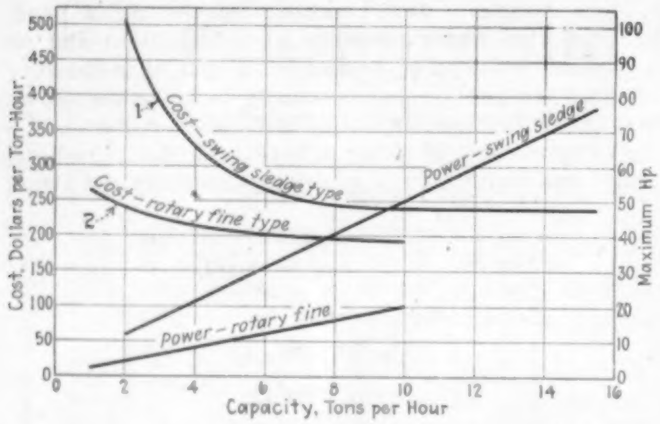


Fig. 4—Cost of Fine Crushers
1. Medium Limestone. Feed: 3 in. Product: $\frac{1}{8}$ in. or less.
2. Medium Limestone. Feed: 3 to 8 in. Product: $\frac{1}{4}$ in. or less.

devices, conveyor belts, screens and magnetic separators, which in total represent an investment greater than that in the mills themselves. Requirements with respect to auxiliaries vary to such an extent that no attempt will be made to standardize these costs.

An element of great importance in the initial outlay for crushing equipment is that of installation. In the case of tube mills of heavy construction and requiring massive foundation blocks, freight charges plus the labor and material incident to erection may amount to 100 per cent of the factory price. The foregoing illustration is much above the average cost of installation, but serves to indicate the possible magnitude of such costs. A point worth noting is that that portion of the initial investment represented by the cost of installation has no salvage value. A conservative accounting method of handling this problem would be to depreciate the book value of the equipment heavily during the first years of its calculated useful life.

The over-all cost of grinding may be divided into two groups, the sum of which should be a minimum for most economical operation. One group, called fixed

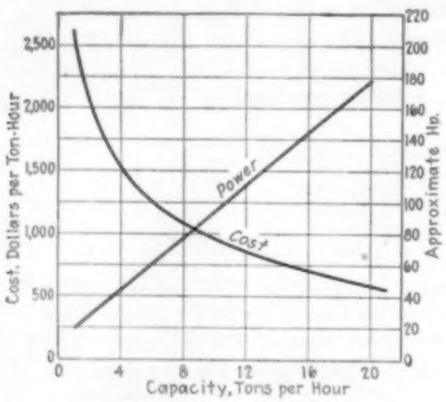


Fig. 5—Cost of Ball Mills
Capacity based on 5 in., 4 in., 3 in. balls grinding limestone from $1\frac{1}{2}$ in. to 48 mesh.

or organization charges, is made up of interest, depreciation, taxes and general administrative expense. The other group—operating charges—includes power, maintenance and labor.

Depreciation constitutes the largest single fixed charge, and on most grinding machines this may be taken at 10 per cent annually. Interest is very nearly 6 per cent over a term of years. Taxes and insurance will fall within 3 per cent in most cases. Administrative overhead will vary to such an extent that it must be determined as a matter of individual policy. In very small installations it may be neglected. On the other hand, the crushing costs of a fertilizer plant or cement mill, for example, should include a considerable portion of general expense. In the machine industries it is a customary and fairly logical procedure to apportion general expense on the basis of direct labor, wages paid or prime cost. It is doubtful whether such a method is good accounting in the chemical engineering industries, where direct labor is such an indefinite and misleading basis. A better practice would be to apportion general expense among the various unit operations on a purely arbitrary basis, taking into account the total operating expenses involved—that is, labor, power and maintenance.

The outstanding item in operating expense is power, which can be predicted with reasonable certainty in any case involving common materials. As a rule, at least 50 per cent overload power is required to start

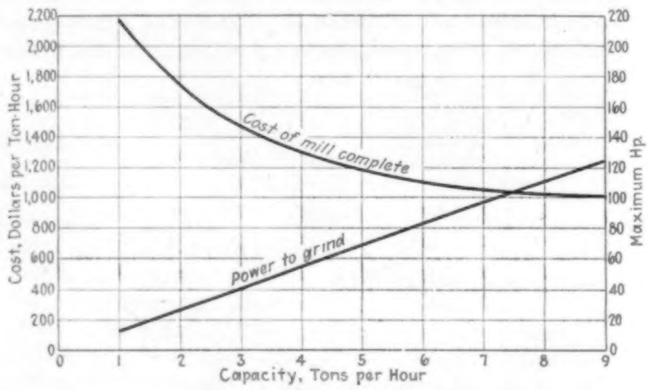


Fig. 6—Cost of Ring Roll Pulverizers
Complete with separator, feeding device and belt drive. Basis: Bituminous coal 1 in. or less. Product: 95 per cent through 100 mesh.

any mill, and heavily loaded ball or tube mills need from twice to five times the normal operating power for starting. The average power requirements of various types of mills is plotted as a function of capacity in Figs. 1 to 6.

Maintenance involves the replacement of the grinding elements and bearings, which in any well-designed mill are easily removable. Maintenance due to ordinary wear is directly proportional to the tonnage handled, and therefore its cost is often expressed in terms of capacity.

The expense of new grinding elements, the accessibility of moving parts and time lost during the repair period are all factors deserving of the most serious consideration in the selection of equipment. While the actual cost of maintenance is best calculated from records of performance, it can be said that high-speed machines will be the most costly to keep in good running order.

Labor charges, although an important item in small installations, do not control in the operating costs of large installations. For example, two men can operate a 400-ton grinding plant about as easily as they can handle a 100-ton plant. Power and maintenance, of course, will go up very nearly proportional to the output.

Illustrative Examples of Grinding Cost

Problem 1—**Tennessee phosphate rock is being ground to 95 per cent through 100 mesh in a battery of two ring roll mills. Operating tests show that the capacity of each mill**

is 5 tons of rock per hour, the power consumption being 17.8 hp. per ton of material ground. Operation is on the basis of 23 hours per day, 300 days per year. One man is required for attendance on each of the two shifts. What is the cost per ton of material ground?

Solution—The cost of roller mills is given in Fig. 6. Since the capacity of these mills on phosphate rock and bituminous coal does not vary much more than 10 per cent, the cost curve may be used without correction. The mill cost will be

$$(2)\ (5)\ (1200) = \$12{,}000$$

Assume freight charges and installation costs to be 40 per cent of this base factory price, making the total investment exclusive of material handling machinery

$$(1.40)\ (12{,}000) = \$16{,}800$$

Interest charges at 6 per cent will amount to

$$(16{,}800)\ (0.06) \div 300 = \$3.36 \text{ per day}$$

Depreciation at an average of 10 per cent will be

$$(16{,}800)\ (0.10) \div 300 = \$5.60 \text{ per day}$$

While taxes and insurance add another 3 per cent

$$(16{,}800)\ (0.03) \div 300 = \$1.68 \text{ per day}$$

Power at 2c. per kw.-hr. will be

$$(0.02)\ (0.746)\ (17.8)\ (2)\ (5)\ (23) = \$61.20 \text{ per day}$$

Labor at 50c. per man-hour will be

$$(0.50)\ (24) = \$12 \text{ per day}$$

Total maintenance (including repairs) will not exceed 20 per cent of the initial investment, or

$$(16{,}800)\ (0.20) \div 300 = \$11.20 \text{ per day.}$$

Summary of Charges:

		% Analysis
Interest on investment	$3.36	3.5
Depreciation	5.60	5.9
Taxes and insurance	1.68	1.8
Power	61.20	64.4
Labor	12.00	12.6
Maintenance and repairs	11.20	11.8
Total daily charges	$95.04	100.0

The cost per ton of material ground is therefore

$$(95.04)\ (100) \div (2)\ (5)\ (23) = 41.3\text{c. per ton.}$$

Problem 2—Medium hard limestone is being reduced from ¼ in. to 95 per cent through 40 mesh in a 4x8 rod mill containing a charge of 6 tons of rods and equipped with chilled iron liners. The output under these conditions is 6.2 tons per hour, and the power consumption averages 46 hp. Operation is 23 hours per day, 300 days per year, and 6 man-hours of labor is chargeable to operation per day. What is the unit cost of reduction?

Solution—The factory cost of mill of this type, complete with liners and a charge of rods is $5,400. Taking freight and installation at 60 per cent of the factory cost, the total initial investment will amount to

$$(1.60)\ (5{,}400) = \$8{,}630$$

The total organization charges, including interest at 6 per cent, depreciation at 10 per cent and taxes and insurance at 3 per cent, amount to

$$(8{,}630)\ (0.19) \div 300 = \$5.47 \text{ per day}$$

Power at 2c. per kw.-hr. will be

$$(0.02)\ (0.746)\ (46)\ (23) = \$15.80 \text{ per day}$$

Labor at 50c. per man-hour equals

$$(0.50)\ (6) = \$3 \text{ per day}$$

Maintenance and repairs, consisting largely of relining expense, replacement of rods and cost of lubrication, can be taken at 15 per cent of the initial investment annually.

$$(8{,}630)\ (0.15) \div 300 = \$4.32 \text{ per day}$$

Summary of Charges:

		% Analysis
Interest on investment	$1.72	6.0
Depreciation	2.88	10.1
Taxes and insurance	0.86	3.0
Power	15.80	55.3
Labor	3.00	10.5
Maintenance and repairs	4.32	15.1
Total daily charges	$28.58	100.0

The unit cost of reduction is therefore

$$(28.58)\ (100) \div (6.2)\ (23) = 20.1\text{c. per ton}$$

The foregoing illustrations indicate the relation of the various fixed and operating charges. In general, power is the largest single item, and opportunities to reduce power consumption by regulating the moisture content of the feed, closed circuit grinding, and by the proper selection of machine type, should be given the most serious consideration.

Thanks are due S. B. Kanowitz, of the Raymond Bros. Impact Co., who kindly read the manuscript.

British Study Gas Production

Waste Heat Boilers—"Regenerative" Complete Gasification—Making Synthetic Methane

One of the elaborate engineering reports made to the British Institution of Gas Engineers late in June dealt with waste heat boiler installations in vertical retort gas plants. Practical operating results on such equipment were reported in detail and numerous engineering drawings presented to illustrate important advances made recently. The important features of the report have been presented in the British periodicals, particularly *Gas Journal* and *Gas World*. The high thermal efficiency attained on what would otherwise be waste gases suggests possibilities of the application in the United States, as well as further application in Great Britain.

At the same meeting of the Institution, a report was made upon the regenerative coal gasification system at Aylesbury by A. G. Lane, an engineer of that company. This is a new cycle for modified water gas, coal gas combination. The complete gasification of bituminous coal is accomplished in a single shell machine which is supplemented by a large regenerator chamber used for superheating the steam employed during the make period.

A third communication to the Institution program of interest to American engineers is the research committee report on conversion of carbon monoxide to methane. It is concluded that the velocity of the reaction between hydrogen and carbon monoxide can be increased seventeen fold by a nickel-thoria catalyst. But owing to the necessity for removing sulphur compounds and for adjusting the ratio of CO to hydrogen in the gas mixture, the process is far too costly for practical application. The thermal efficiency of the process would be very low because important unsaturated hydrocarbons would be eliminated and a considerable part of the original carbon monoxide lost by conversion to carbon dioxide.

Oil Refineries Increase in Number

According to compilations recently completed, there are 563 oil refineries in the United States at the present time, an increase of 84 such plants since Jan. 1, 1922, the last date of prior official figures made by the Bureau of Mines, when 479 plants were recorded. The present daily rated output of all refineries is stated to be 2,930,640 bbl., an increase of 35 per cent over previous figures at the time noted. Texas leads all other states in the number of plants, while California stands first in refinery capacity. Texas is credited with a gross of 120 refineries; Oklahoma, 103; California, 79; Pennsylvania, 61; and Louisiana with 29. The total rated capacity of the refining plants in California is 663,750 bbl. per day; Texas, 545,300 bbl.; Oklahoma, 353,600 bbl; and Pennsylvania, 153,700 bbl. Louisiana, with but 29 such plants, has a refining capacity of 206,730 bbl. daily, while New Jersey, with 11 refineries, has a rated daily output of 249,500 bbl.

A Successful Experiment in

Industrial Education

How One Large Company Is Training Its Foremen and Operating Bosses in Economics, Mathematics and the Technology of Its Industry

By D. J. Roach
Manager, Fort Collins and Windsor Factories, Great Western Sugar Co.

IN THE past few years considerable attention and study have been given by the various industries of the country to the subject of industrial education. Business executives and social agencies have come to the realization that generally the workmen of American industry are not as well trained for their work as they should be if America is to take and maintain its proper place in the world's production. The fruition of this realization of educational needs has been an attempt by industrial organizations, governmental organizations such as the Federal Board of Vocational Education and social organizations such as the Y. M. C. A. to carry to the men engaged some sort of training and education that would make them better workmen and better citizens. Our company, the Great Western Sugar Co., in common with hundreds of other companies, realized this need and in 1918 began a program of industrial education among the operating men at its various plants and it is this program and its results that I wish to discuss.

Industry a Seasonal One

The beet-sugar industry, because of the fact that its raw material—namely, sugar beets—is perishable, is a seasonal industry and the actual manufacturing of sugar is carried on for only a period of 90 to 100 days out of each year. This means that the production organization is not continuous, but must be built up and disbanded each year. Anyone who is familiar with organization problems will realize what this means. However, the nucleus of the organization, composed of the foremen and best station operators and the highest grade mechanics, are carried over on repair work from one operating season to the next, and around this nucleus is built up the production or operating organization.

The number of such men carried over the entire year is very few when compared with the total number employed during the operating season, since at a small factory a year around organization of 40 men must be expanded to 275 during the operating season, while at a large factory a permanent crew of 70 men is expanded to an operating organization of 530 men. In other words, out of a total operating organization of 6,000 men at all sixteen plants of the company, only about 700 men are kept throughout the entire year.

Upon this small nucleus rests the burden of organizing each year a large group of inexperienced workers into an efficient production unit, and the fact that this is accomplished each year is evidence that these men are fundamentally of high quality. It is the aggregation of this nucleus at the various factories that we consider our operating organization and it was these men in whom we were most interested in our industrial education program.

The great majority of the permanent employees have come up from the ranks. They are the men who, out of the many thousands of campaign employees, have showed themselves to be the most capable and best workmen. They are, in truth, a picked aggregation of men and yet a considerable number of them have been forced through circumstances to leave school at such an early age that they were able to secure only a very meager general education. In the same way, although they had learned the practical manipulation of the machinery and of the process, few of them understood the theory and technology surrounding the process of beet-sugar manufacture.

Objects of the Course

With these things in mind, it was felt by our officials that if by means of a program of industrial education the general education of our operating men could be improved and if they could be given a broader knowledge of sugar technology, our operations as a whole would be improved, the men themselves would be improved and more of our operating executives could be taken from the rank and file of foremen.

This program was begun in the summer of 1918, when in co-operation with the extension department of the University of Colorado, classes in elementary and applied mathematics were conducted at three of the factories. The men took a fair amount of interest and considerable was accomplished. However, it was soon realized that the schools were too narrow and a more comprehensive plan was worked out for the schools given during the summer of 1919. This plan was to give the following courses:

a. Elementary Mathematics.
b. English.
c. Industrial History.
d. Sugar Technology.

With the course in elementary mathematics we had excellent results. The men realized very generally the need for this training. Thy were eager to take it up and the interest was well sustained. Much good was accomplished by the course. In English we found a great need for instruction, but at the same time a lack of interest. The men generally remembered very keenly the days of public school grammar, which as taught 15 or 20 years ago was pretty much of a bore, and they were wary of again trying out anything along this line. However, we tried out a course in English consisting of letter and report writing combined with some grammar, but it was the least successful of all of the courses given. In every industrial organization need for training in English exists, but it will be found to be the most difficult course actually to get across to the men.

Correcting Misunderstandings of Workers

The course in industrial history and elementary economics is, to my mind, of utmost importance in a properly balanced program of industrial education. We all know that today throughout the industrial world there is a condition of instability due to the fact that there is a lack of understanding between the workers and the owners. This lack of understanding must be corrected, and nothing will help more in correcting such a misunderstanding than a knowledge of industrial history and economics by the workers and particularly by the foremen. When the workers realize that the present industrial wage system is a result of centuries of evolution and building and that in this evolution the

worker's economic condition has constantly grown better, they will come to understand that the present system cannot be torn down or changed in a day without a terrible chaos resulting. This understanding will mean greater industrial stability. We found the men much interested in this study, and we believe that the course was worth while. For the best success, however, a text book cannot be followed, but courses especially adapted to the men under instruction should be given.

Course Prepared by the Company

In beginning our work in sugar technology we early realized that no suitable book existed for the purpose that was before us and that if we were to give a course that would be successful, such a course would need be prepared within the company itself. With this in view, a course in sugar technology was blocked out and several men who had special knowledge in the various phases of sugar technology were asked to prepare lectures on those parts in which they were particularly interested. These separate lectures were then edited by one person in order to give continuity to the whole and were sent to the factory, where they were given to the men in a course of 16 weeks each for 2 years, or a total of thirty-two lectures. Where the subject matter permitted each chapter or lecture was divided into two sections, section *a* representing a descriptive treatise for the beginner, and section *b* a more theoretical treatment for the advanced student. The lectures were delivered at each factory by the superintendent or someone designated by him who was particularly fitted for such work. After each lecture was delivered the whole was discussed by all present.

Men Interested in the Technology of Their Work

The course in technology was very well received by the men and good interest was maintained during the entire course. The foremen realized that here was a chance to perfect themselves in the technique of the business and to prepare themselves for better positions in a much shorter time than would it have been possible through the ordinary operation of their job. Here they had available in one course a comprehensive operating knowledge of the company which in the ordinary course of events would have taken them many years to have acquired. This work in technology was given at the same time as the work in general education, and in fact it was these lectures that helped materially in keeping interest alive in the rest of the course. It was something that the men could see and immediately use and they were willing to give time and study to the acquisition of such knowledge. From the standpoint of the company the course gave the men, the permanent organization, a keen, clear and more thorough knowledge of the business than they had before and it brought a number of these men up to the point where they were ready for promotion much sooner than would have been the case otherwise.

A good bit of the industrial education program during the past several years over the country has been devoted to so-called "foremanship training" work, wherein foremen or men desiring to become foremen are trained specifically in the factors of foremanship. We have investigated this work and our analysis has led us to the conclusion that this training is really of a twofold nature. That is (*a*) inspirational, (*b*) training in job management.

The inspirational phase of foremanship training means, as we see it, training the foremen in the handling of men not only from the standpoint of working them and using them efficiently as part of the working equipment or machinery but more particularly using them as men, getting the work out of them and yet retaining and furthering among the men such spiritual qualities as self-respect, job pride and firm organization pride, all of which makes a live and contented industrial organization. This training is not of a tangible nature in manual, technical or mental skill such as technical or even managementship training may be, but it is more or less intangible and is closely related to character building.

The company has co-operated with the industrial department of the Colorado State Y.M.C.A. in carrying a program of industrial training to our foremen. This has been done in two ways; first, by sending picked men each year to the Estes Park Industrial Conference, and second, by bringing specially trained lecturers before monthly meetings of the whole body of foremen. We believe this work to have been well worth while and that it should not be neglected, for it does much to give foremen and other executives an appreciation of what they owe to the men underneath them.

Training in job management as carried out by a number of agencies, particularly the Federal Board for Vocational Education, has not as yet been attempted by our company. We have investigated the work, but it has seemed to us that much adaptation is needed before it can be successfully applied to our industry and so far we have not been able to make this adaptation. I believe that there is need for job management training in our industry and hope and expect that arrangements will be made to bring this training to our foremen within the near future.

Plan Believed to Be Successful

In looking over the program of industrial education which our company has attempted, we believe that we have had fair success. Sometimes progress has been slow, but on the whole much good has been accomplished. Our company has made very large strides in operating efficiency during the years 1920, 1921, 1922 and 1923, and it is acknowledged by all that part of this increased efficiency has been due to the various agencies of industrial education that we have given to our men.

In general, I think, our men who took this work realize that they have been well repaid for the time and study they have given, in that they are better men in their positions and that they are more nearly prepared for promotion than they were before, while at the same time the company officials feel that the company has already made big dividends on the money that the schools cost them and that they have a better trained, more capable organization than they had before.

China Develops Match Industry

During the past ten years the match business of China has steadily grown until now it has reached the point where it can supply all of its domestic requirements, according to a report from Consul-General Edwin S. Cunningham, Shanghai. In past years China's supply of matches was supplied principally by Japan with some shipments from Europe, but the realization of the ease of manufacture has given an impetus to the home industry.

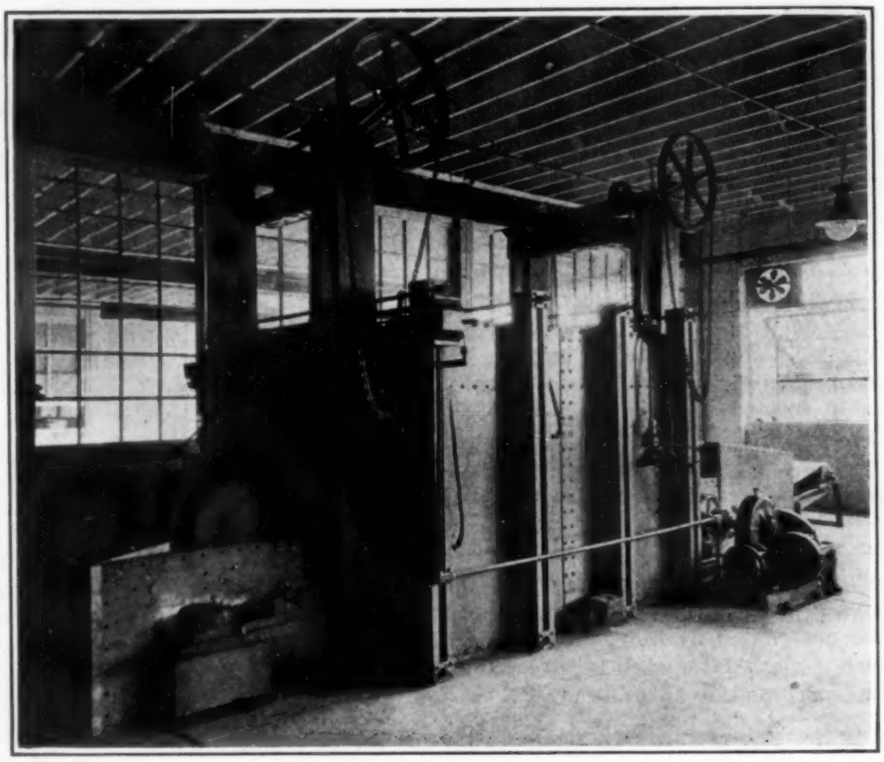
Equipment News

From Maker and User

Continuous Enameling Furnace

In the vitreous enameling of metal parts one thing that has often impressed the thoughtful operator is the very considerable loss of heat due to opening the doors of a furnace while charging and removing the work. It is quite certain, too, that aside from the consequent loss of heat, this periodic opening of the doors causes a fluctuation in furnace temperature that may be harmful as well as slowing up the operation of fusing the enamel, to say nothing of the discomfort and delay in removing the work from the fork and the length of time when there is nothing in the furnace.

Possibly these things prompted the development by C. C. Armstrong, of the Armstrong Manufacturing Co., Huntington, W. Va., of an electrically operated furnace for enameling comparatively flat pieces whereby the opening and closing of charging doors is eliminated through the medium of a conveyor which carries the work through the furnace from the charging end and discharges it at the opposite end. It is more accurate to say that the doors are continuously open rather than not being opened at all. That is, they are adjusted to open only sufficiently to allow the passage of the work in and out of the furnace, depending upon the height of the pieces being fired.



Continuous Electric Enameling Furnace

The furnace proper does not differ materially from the ordinary electrically heated enameling furnace. The heating chamber is 9 ft. 8 in. long, 30 in. tall and 32 in. in width.

The conveyor is built up from a number of Nichrome "burning bars" 30 in. in length, 1 in. wide by ¼ in. thick. These blades are fastened vertically in pairs to cast Nichrome links and stand 3⅝ in. apart. The chain is completed by the use of connecting links made from $\frac{3}{16}$ x ⅝ in. Nichrome bars, which are movably attached to the cast links by means of Nichrome pins ⅝ in. in diameter. Three complete chains support the knife-edged Nichrome burning bars, one in the center and one at either end. The conveyor chain on its passage through the furnace slides over three Nichrome bars 2 in. wide by ¼ in. thick extending from end to end of the heating chamber and supported on cross-bars that rest on a ledge built into the side walls of the furnace under the side heating elements and in the center on small piers about 12 in. apart. Resting on these same cross bars are two Nichrome plates 10 in. wide, by $\frac{3}{16}$ in. thick, extending the length of the furnace, which cover the heating elements under the conveyor and protect them from anything falling on them. The conveyor returns beneath the furnace through a well-insulated tunnel and over an idler sprocket. The chains and bars comprising the conveyor are carried over cast-steel sprockets mounted at each end of the furnace, which are made in the form of a drum to prevent the parts falling through and to help prevent heat losses.

The set of three of these sprockets (which are 26 in. in diameter) at the discharge end of the furnace is driven by an electric motor through a speed-reducing mechanism and a speed change box with nine changes of speeds so that the conveyor can be made to travel at will to allow work to remain from 1½ to 3½ minutes in its passage through the heating chamber. The set of sprockets engaging the conveyor at the charging end is an idling set and is carried on bearings adjustable longitudinally by spring tension to compensate for the change in the length of the chain due to its change in temperature.

The centers of the driving and idling sprockets over which the conveyor works are 42 in. beyond either end of the furnace to allow for proper charging and discharging on a convenient flat surface. At the discharge end of the furnace well below the center of the sprockets driving the conveyor is located an auxiliary conveyor working at double the speed of the main conveyor on which the work falls as it leaves the main conveyor after passing through the furnace. This auxiliary conveyor is constructed of a reinforced asbestos belt 31 in. in width. This belt is 10 ft. in length and is covered for 5 ft. of its length next to the furnace by an insulated tunnel, which serves as a cooling chamber, giving the work an opportunity to cool somewhat before it approaches the outer air temperature. This cooling chamber also serves to retard the loss of heat through the slightly raised door at the rear end of the furnace.

In addition to being protected by the usual thickly insulated doors counterweighted in the usual manner, there is attached to each door a hood which is adjustable with the door for height and which entirely covers the main conveyor at the discharge end of the furnace and leaves at the charging end of the furnace only sufficient room for feeding in the work to be burned.

Because of its comparatively light construction and its nearly complete protection from contact with the outside air, the loss of heat due to the passage of the main conveyor through the furnace has been found to be relatively unimportant. The temperature of the furnace is automatically controlled by a Leeds & Northrup controlling and recording instrument, which makes and breaks the full load of 105 kw. The power is 250 volts, sixty cycle, three phase. Two persons

are required for the operation of the furnace—one to place pieces on conveyor and one to remove them from the auxiliary conveyor.

The furnace has been in operation for several months, enameling steel shells 0.035 in. thick, measuring 7⅛ in. square by 2¼ in. tall. The furnace easily handles these pieces on first coat work at the rate of 600 pieces per hour. On second and third white coats and on firing decals the rate is 800 pieces per hour. The loss due to improper firing is practically negligible, amounting to under ⅓ of 1 per cent in the experience thus far. Larger shells, 20⅛ in. square by 4 in. in depth, are handled with satisfactory speed, though production of these pieces at this time has not been in sufficient volume to determine accurately what can be expected in the way of output.

It will be apparent that the furnace is remarkably successful, both from the standpoint of rapidity of operation as well as the almost entire absence of loss due to improper firing. Once the proper speed of the conveyor and the proper heat of the furnace is found for a certain part, the results are entirely uniform. The furnace was built and installed by the Electric Furnace Construction Co., 1015 Chestnut St., Philadelphia, Pa.

Water Evaporator

A new evaporator designed for the production of pure distilled water for boiler feed make-up has recently been placed on the market by the Griscom-Russell Co., 90 West St., New York City. It is said that water purification by means of this device eliminates all scale-forming material from the water before it enters the boiler, thus improving plant operation. The evaporator is called the "G-R Bentube Evaporator."

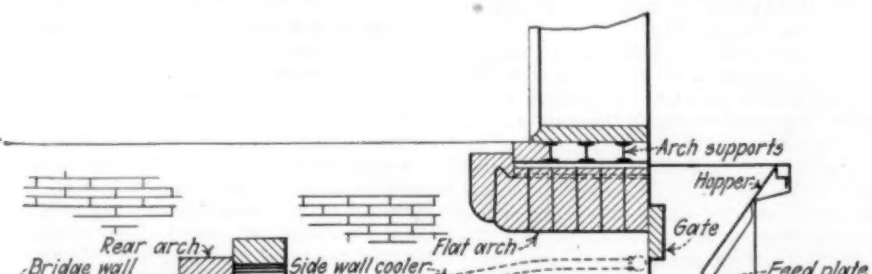
The essential features of construction are a shell and vapor dome of welded steel plate, with tube headers of cast iron into which are expanded seamless drawn Admiralty tubes which are bowed. The steam enters the tubes and evaporates the raw water in the shell. These bowed tubes distort with temperature changes, effectively cracking off accumulated scale. The tube bundle consists of a series of independent vertical sections, each easily removable for inspection.

Stoker for Small Furnaces

Stokers have proved such efficient aids to the conduct of combustion in large furnaces that attention has lately been turned to their application to smaller furnaces for boilers and industrial plants. One of the results of this is the "King Coal" stoker, recently placed on the market by the Stoker Sales Co., 650 Old Colony Building, Chicago, Ill.

This Stoker is designed to burn screenings or any coal below the grade of No. 2, smokelessly, and is claimed to give excellent smokeless results with high-volatile screenings from Western coals. Other claims made for the device are that it reduces fuel cost, because it burns cheap coals, decreases the amount of coal consumed, reduces the volume of ash and eliminates smoke. It is also claimed to be as automatic as an oil burner, combining the convenience of the latter with the safety and economy of coal.

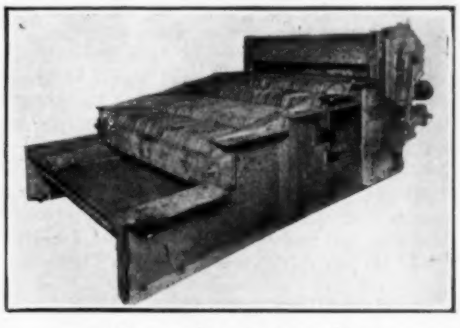
In design, this device is simple, as will be noted from the accompanying sketch. Forming the base of the coal hopper there is a reciprocating plate, carried on roller bearings, which has a travel up to 5 in.—the length of travel determining the amount of the coal fed. The grates are terraced or stepped and are arranged in series. The first set of grate bars rests upon and slides over the second step of the grate. The first and third grates have a forward and backward sliding motion (their action being simultaneous) and the second and fourth grates are stationary. By this motion the grate bars literally slide out from under the coal, the bed of coal being disturbed only by its fall over the ends of the grate bars. Because of this action, even coal with coking properties, can be burned with efficiency equal to that obtained from non-coking coals.



Diagrammatic Sketch of Stoker for Small Furnaces

A distinctive feature of the stoker is the plate or table directly under the ash opening at the rear. This plate supports the body of the ash as it falls from the fourth grate. Having a reciprocating action it also provides a slow but definite travel of the ash toward the front, but at all times fills the throat or ash opening so as to seal it against an inrush of cold air. In this way practically 100 per cent of the ash heat is retained and complete combustion is made possible.

Either natural or forced draft can be employed and the stoker is operated by a ¼-hp. motor or hydraulic drive of equivalent power. There are only three moving parts throughout the entire mechanism, which explains the small amount of power required for operation.


View of Stoker Assembled

A test was recently run on the stoker, which had been installed in a boiler of the HRT type and of 150 hp. The following are the results of this test:

Coal Analysis:	Hand-Fired Shaking Grate Natural Draft Pocahontas	King Coal Stoker Forced Draft Ill. Screenings
Moisture	1.37	5.59
Ash	4.93	8.99
Volatile	22.03	31.98
Fixed carbon	71.67	53.44
B.t.u.	14,751	12,625
Smoke observed	Practically Smokeless	Absolutely Smokeless
CO_2 average	6.70	13.01
Horsepower, average	71.	237.
Evaporation per lb. coal fired	6.35	9.11
Combustible in ash (wasted fuel)	45.81	12.06
Cost of evaporating 1,000 lb. water, cents	.57	.26
Duration of test, hours	8	8

Manufacturers' Latest Publications

The Brown Instrument Co., Philadelphia, Pa.—A booklet describing the processes of annealing and mold drying at the Union Steel Castings Co., Pittsburgh, Pa., detailing the utility of Brown Pyrometers for these operations.

Edward Valve & Mfg. Co., East Chicago, Ind.—Catalog 8. A general catalog of the Edward line of valves for all services including forged steel valves for high-pressure work such as is encountered in oil refineries and modern power plants.

Oxweld Acetylene Co., 302 Thompson Ave., Long Island City, N. Y.—A new general catalog describing this company's full line of equipment for welding, cutting, brazing, lead-burning, heating and decarbonizing.

Griscom-Russell Co., 90 West St., New York City.—Form 195. A leaflet describing the "G-R Bentube" Evaporator for providing pure distilled water for boiler-feed make-up.

Review of Recent Patents

Paint and Varnish Remover

In Patent 1,499,101 (assigned to Chadeloid Chemical Co., June 24, 1924), Carleton Ellis, of Montclair, N. J., has presented a comprehensive survey of the properties to be considered in developing paint and varnish removers, among them penetrating and loosening action, non-flammability, film formation, odor, corrosive action, consistency and availability of raw material.

This study was made in attempting to find a composition less flammable than the present highly efficient mixture of benzol, acetone and wax. It has been found that mixtures containing wax, trichlorethylene, a heavy alcohol and an ester boiling between 75 and 100 deg. C. are quite satisfactory. One example is: trichlorethylene, 60 per cent; benzyl alcohol, 30 per cent; ethyl acetate, 10 per cent; from 4 to 6 per cent of paraffine wax being added to the mixture.

Adherent Insecticide

Samuel Wilson, of Brooklyn, N. Y., has applied the foam-forming properties of mixtures of solutions of such materials as aluminum sulphate and sodium bicarbonate to the problem of making adherent fungicides and insecticides. The separate solutions for foam production are prepared as usual and the desired insecticides are added to one of the solutions. Nicotine, hellebore, copper sulphate, sulphur and Paris green are best mixed with the aluminum sulphate, while cyanides, lead arsenate and soaps may be added to the sodium bicarbonate. A typical composition is:

Solution A

Water	25 gal.
Aluminum sulphate	3 lb.
Nicotine sulphate	½ oz.
Saponine	¾ oz.

Solution B

Water	25 gal.
Sodium bicarbonate	5 lb.
Resin soap	4 lb.
Sodium cyanide	1 lb.

Upon mixing a persistent foam is formed which insures long and intimate contact of the insecticide with the plant or tree surface. (1,501,427, July 15, 1924.)

Recovering Lactose From Whey

Whey contains 4.5 to 6 per cent lactose, 0.8 per cent protein, 1 to 2 per cent mineral salts (chiefly Ca and Mg) and 0.2 to 0.8 per cent lactic acid. After concentrating to 30 deg. Bé. in vacuum pans, crystallization yields crude yellow lactose equivalent to about 3.8 per cent on the basis of the original whey. By coagulating the albumen in the mother liquor with live steam a second crop of crude crystals may be obtained, equivalent to 0.3 to 0.6 per cent. The crude is dissolved, proteins precipitated by phosphoric acid, heated, $MgSO_4$ added to precipitate the phosphoric acid.

Roger W. Ryan, of Oconomowoc, Wis., has modified the purification process as follows: Whey partly clarified by adding 0.5 per cent alum, boiling, filtering and cooling, is treated with sufficient milk of lime to neutralize acidity and give a slight excess. Carbon dioxide is then passed into the solution, precipitating calcium and magnesium carbonates and also acting to precipitate the phosphates of the whey. Heating to 180 deg. F. coagulates nitrogenous matter and decomposes any acid phosphates and bicarbonates of calcium and magnesium that may have been formed. Heating is continued until the acidity is 0.001 to 0.004 normal, which range is most effective for protein precipitation. After filtering, the clear liquor is evaporated and crystallized. (1,500,770, assigned to Carnation Milk Products Co., Seattle, Wash., July 8, 1924.)

Decolorizing Carbon

An extract is made from brown coal or peat by treating it with sodium carbonate solution. This alkaline extract is intimately mixed by grinding, with 5 to 10 times its weight of common salt, and heated in the absence of air. Before being used the decolorizing carbon is freed from substances that are soluble in the liquid to be treated by washing with water or acids. (1,501,321, Wilhelm Eberlein, of Ahrenburg, Germany, assignor, by mesne assignments, to Chemical Foundation, Inc., July 15, 1924.)

Iron Oxide Pigment

Byproduct ferrous chloride from galvanizer's waste pickle may be converted into bright red iron oxide suitable for use as pigment according to a method developed by Daniel Tyrer, of Stockton-upon-Tees, England.

Granular ferrous chloride is heated to 250 to 300 deg. C. in a closed muffle furnace and a mixture of air and water vapor is passed through the muffle. The best mixture is obtained by passing air at ordinary temperature through water kept at 60 deg. C. In order to obtain the best color of oxide, the rate of air and vapor flow is regulated so that the condensate does not contain more than 30 g. HCl per 100 c.c. About 50 per cent of the HCl liberated is recovered in the condenser. The remaining HCl may be obtained as weak liquor by scrubbing with water. Iron compounds and salts of copper, magnesium, tin, sodium and potassium act catalytically to accelerate the reaction. (1,501,873, July 15, 1924.)

Dehydrated Phosphoric Acid

For use in rust-inhibiting compositions where mixtures of phosphoric acid and oil may be desired it is advantageous to have water-free phosphoric acid. This may be obtained according to James H. Gravell, of Elkins Park, Pa., by adding to the 85 per cent acid sufficient phosphorus pentoxide to react with the water present. The dehydrated acid is at first liquid but tends to crystallize on standing. This may be avoided by dissolving the dehydrated acid in a suitable solvent, such as butyl alcohol. (1,499,611, July 1, 1924.)

Electrolyte for Rectifiers

Joseph Slepian, of Swissvale, Pa., has patented an electrolyte for electrolytic condensers, rectifiers, lightning arresters, etc., that gives a low power factor, is capable of use at high temperatures and does not deposit precipitates in any appreciable amount. Phosphates and borates are both used, a preferred formula being: Water, 1,200 g.; borax, 11.25 g.; trisodium phosphate, 5.75 g.; sodium fluoride, 1 g. Continuous operation at or above 90 deg. C., with a power factor between 4 and 5 per cent and clean electrodes is possible with this electrolyte. (1,499,-414, assigned to Westinghouse Electric & Mfg. Co., July 1, 1924.)

Bleaching Monosulphite Fiber

Vegetable fiber which has been cooked and refined by boiling 8 to 10 hr. at 100 lb. pressure in strong solutions of sodium, potassium or magnesium monosulphite, can be effectively bleached, according to Viggo Drewsen, of Brooklyn, N. Y., by bleaching powder after a preliminary treatment with chlorine. The chlorine seems to combine with some component that has an unsaturated or side linkage, as the liquor remains neutral and the chlorinated product is very readily soluble in hot or cold water. Chlorine is passed into a 3 per cent pulp mixture until no further absorption takes place. The derivatives are washed out and further bleaching, if desired, may be obtained by using 2 or 3 per cent of 37 per cent bleach. (1,500,378, assigned to West Virginia Pulp & Paper Co., July 8, 1924.)

Latex in Paper

Frederick Kaye, of Ashton-on-Mersey, England, has patented the addition of rubber latex to paper pulp for the production of a paper with high tensile strength, resistance to abrasion and to repeated bending while under tension.

Latex, at a dilution of 1 to 0.1 per cent, is added to pulp in the beater and subsequently a coagulative agent such as acetic acid is added. The sheet is formed as usual and may be vulcanized after drying. The folding number, as determined by the Schopper folding machine, of samples of paper containing 0.5 per cent of rubber and vulcanized, has reached 5,000 to 6,000. The bursting strength of many chemical wood pulp papers containing rubber is equal to that of kraft process paper. (1,500,500, July 8. 1924.)

Calcining Carbon for Electrodes

For brushes, electrodes, etc., lampblack and gas black are customarily used because their ash content is less than 0.20 per cent. Preliminary calcination is necessary in order to impart

the requisite electrical conductivity and density. The usual process of forming briquets after adding coal tar and calcining the briquets in large furnaces has the disadvantage of long operating time with consequent high costs for fuel and attendance.

Victor C. Hamister, of Cleveland, Ohio, has found that it is possible to conduct the calcination continuously. Raw lampblack (135 lb.) is mixed with light coal tar (180 lb.) to form a plastic mass. This is fed continuously to a rotating tubular externally-fired furnace where its temperature is progressively increased with the progressive expulsion of the volatile substances present. By the time a temperature of 300 deg. C. is reached, the expulsion of volatile matter and the tumbling action brought about by the rotation of the tube have reduced the material to the form of hard, rounded, partially coked nodules which may vary in diameter from ⅛ to ½ in. or more. With further increase of temperature to a red heat, the nodules experience no change in form, but additional volatile matter is expelled. The final temperature may be 500 to 900 deg. C. depending on the properties which it is desired to impart to the material. Good results have been obtained with a final temperature of 700 deg. C. The hot nodulized material is discharged and protected from oxidation until it is sufficiently cooled, after which it may be ground and treated by the usual processes for forming electrodes, etc. (1,501,108, assigned, by mesne assignments to National Carbon Co., July 15, 1924.)

Paraldehyde Resin

Resinification reactions between phenol and acetaldehyde are carried out with some difficulty owing to the highly volatile nature of acetaldehyde. On the other hand paraldehyde is a liquid which can be readily shipped and handled. Acetaldehyde reacts with phenol with the evolution of considerable heat. Paraldehyde when broken down into acetaldehyde by the addition of a small quantity of strong mineral acid absorbs heat. Carleton Ellis, of Montclair, N. J., has found that by proportioning the rate of addition of the paraldehyde a satisfactory control of the temperature of the batch may be obtained.

Thus for example approximately 100 parts of phenol are acidulated with 1 part of concentrated hydrochloric acid and 50 parts of paraldehyde are added very slowly. Reaction takes place and the paraldehyde may be added at such a rate as to permit the reaction mixture to become warm. It is allowed to stand for a time, for example overnight, and the following day is heated for 1 hr. at a temperature of 150 deg. C. under reflux condenser.

Finally any free mineral acid may be neutralized by the addition of a small quantity of sodium carbonate or other neutralizing agent. The resin so obtained may be dissolved in a solvent such as acetone and mixed with asbestos fiber or other filling material. It may be molded in the cold and subsequently baked according to the cold molding procedure or it may be molded in hot press. (1,500,303, July 8, 1924.)

U. S. Patents Issued August 5, 1924

Regenerative-Furnace Construction. Walter O. Amsler, Pittsburgh, Pa.—1,503,464.

Reversing Valve for Regenerative Furnaces. Walter O. Amsler, Pittsburgh, Pa. —1,503,465.

Process of Forming Sodium Carbonate. Herbert Edwin Cocksedge, Hartford, England, assignor to The Solvay Process Co., Solvay, N. Y.—1,503,481.

Priming Mixture for Propellent Explosives. Clarence I. B. Henning, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,503,530.

Electrode Holder. Henry Thomas Lintott, South San Francisco, and Henry John Charbonneau, San Francisco, Calif.—1,503,541.

Apparatus for Cooking Pulp-Making Fibers. Treadway B. Munroe, Forest Glen, Md., assignor to C. F. Dahlberg, New Orleans, La.—1,503,549.

Electric Furnace and Precipitator for Producing Oxide of Zinc. John Thomson, Brooklyn, and Francis A. J. Fitzgerald, Niagara Falls, N. Y.—1,503,564.

Process of Finishing the Edges of Glass Sheets. Austin C. Hileman, Ford City, Pa., assignor to Pittsburgh Plate Glass Co.—1,503,586.

Process of Producing Crystalline Aluminum Sulphate. Sherman W. Scofield and John B. La Rue, Cleveland, Ohio.—1,503,603.

Process of Making Cellulose Ether. Paul C. Seel, Rochester, N. Y., assignor to Eastman Kodak Co., Rochester, N. Y.—1,503,604.

Sound-Deadening Fiber Board. John K. Shaw, Minneapolis, Minn., assignor to C. F. Dahlberg, St. Paul, Minn.—1,503,605.

Edge Holding and Forming Device for Sheet-Glass Machines. Harry G. Slingluff, Mount Vernon, Ohio, assignor to Pittsburgh Plate Glass Co.—1,503,608.

Paper Manufacture. William L. Taylor, Cincinnati, Ohio.—1,503,613.

Process of Making Pungent Compounds. Donald B. Bradner and Mary L. Sherrill, Baltimore, Md.—1,503,631.

Method for Annealing Sheet Metal. Otto H. Cunningham, Leechburg, Pa.—1,503,639.

Sugar Manufacture. John V. N. Dorr, New Canaan, Conn., assignor to The Dorr Co.—1,503,644.

Emulsifying Apparatus. George L. Fish, Long Beach, Calif.—1,503,646.

Process for Producing Aluminum Chloride. Frank W. Hall, Port Arthur, Tex., assignor to The Texas Co., New York, N. Y.—1,503,648.

Process of Manufacturing Sugar. Phillip M. McHugh, Denver, Colo., assignor to The Dorr Co.—1,503,657.

Method of and Apparatus for Making Annular Sheets of Rubber. Fred Thomas Roberts, Cleveland, Ohio.—1,503,665.

Mold for Making Hollow Articles of Plastic Material. Fred Thomas Roberts, Philadelphia, Pa.—1,503,666.

Method of Making Hollow Rubber Articles. William E. Roberts, Andover, Mass.—1,503,667.

Drainage Plate for Expressing Presses. Charles B. Upton, Piqua, Ohio.—1,503,673.

Paper-Machine Drive. George S. Witham, Jr., Hudson Falls, N. Y.—1,503,679.

Process of Treating Glass. Frank G. McPherson, Beaver Falls, Pa.—1,503,695.

Rubber Vulcanization and Product Thereof. Harold A. Morton, Akron, Ohio. —1,503,702.

Grinding Mill for Rocks, Ores, and Like Material. Edward H. Moyle, Los Angeles, Calif.—1,503,703.

Tunnel Kiln With Steam-Generating Cooling Zone. Conrad Dressler, New York, N. Y., assignor to American Dressler Tunnel Kilns, Inc., New York, N. Y.—1,503,750.

Method of Extracting Oil. Carl Dreymann, Baltimore, Md.—1,503,751.

Air-Conditioning Device. Burt S. Harrison, Chicago, Ill., assignor to Drying Systems, Inc., Chicago, Ill.—1,503,755.

Alloy for High-Temperature Use. William H. Smith, East Cleveland, Ohio, assignor to Electro Metallurgical Co.—1,503,772.

Means for Discharging Granular and Like Material from Retorts and Similar Vessels. Thomas William Stainer Hutchins, Davenham, England.—1,503,791.

Method of Blending Gasoline. Thomas L. Kerr, Bigheart, Okla., assignor on one-half to Kork Kelley, Dallas, Tex.—1,503,792.

Method of Welding Metals. Hans Goldschmidt and Gustav Schonwald, Berlin, Germany, assignors to Gesellschaft für Aluminothermie, Berlin, Germany.—1,503,825.

Process of Welding Cast Iron to Steel. Preston M. Hall, Swampscott, Mass., assignor to Thompson Electric Welding Company, Boston, Mass.—1,503,827.

Solidified Liquid Fuel and Process of Making the Same. Herbert Ktanich, Brooklyn, N. Y., assignor to S. Sternau & Co., Inc., Brooklyn, N. Y.—1,503,835.

Heat-Exchange Apparatus. Oliver Piette, Brussels, Belgium.—1,503,846.

Meat Product and Method of Making the Same. Charles H. Vogt, Philadelphia, Pa., assignor to F. G. Vogt & Sons, Incorporated, Philadelphia, Pa.—1,503,864.

Process of Treating Milk and Milk Products. George Grindrod, Oconomowoc, Wis., assignor to Carnation Milk Products Co., Chicago, Ill.—1,503,892.

Process for the Manufacture of Aromatic Sulphonic Acids. Frank A. Canon, Crafton, Pa., assignor to The Barrett Co.—1,503,937.

Explosive and Process of Making Same. Harry W. Klinger, Kenvil, N. J., assignor to Hercules Powder Co., Wilmington, Del. —1,503,956.

Composite Moistureproof Board. Otto Kress, Appleton, Wis., assignor to American Lakes Paper Co.—1,503,957.

Centrifugal Machine and Process. Richard Mackay, Jr., Riverside, Ill., assignor to The Barrett Co.—1,503,960.

Manufacture of 2.3-Hydroxynaphthoic Acid. Lee H. Cone, Mountain Lakes, N. J., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,503,984.

Enameling Process. Henry Moecker, Jr., Homewood, Ill., assignor to American Stove Co., St. Louis, Mo.—1,503,991.

These patents have been selected from the latest available issue of the "Official Gazette" of the United States Patent Office because they appear to have pertinent interest for "Chem. & Met." readers. They will be studied later by "Chem. & Met.'s" staff, and those which, in our judgment, are most worthy, will be published in abstract.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Rotary Filter or Strainer. Francis Whitwell Brackett, Colchester, England. —1,504,020.

Method of Preparing Oxides of Tungsten and Similar Materials. Ben B. Fogler, Cleveland, Ohio, assignor to General Electric Co.—1,504,036.

Production of O-Nitro-o-Aminophenol-p-Sulphonic Acid and Its Derivatives. Homer W. Hillyer, Farmington, Conn., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,504,044.

Triphenylmethane Dyes. Lucas P. Kyrides, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,504,060.

Tetrakisazo Dyes. Werner Lange, Berlin-Friedenau, and Ludwig Neumann, Berlin, Germany, assignors to Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany.—1,504,125.

Disazo Dye. Wilhelm Neelmeier and Karl Heusner, Leverkusen, Germany, assignor to Farbenfabriken vorm. Friedr. Bayer and Co., Leverkusen, Germany.—1,504,134.

Manufacture of Paper for Photographic Purposes. Eduard Schloemann, Duren, Germany.—1,504,150.

Manufacture of Dyestuff Intermediates. John Thomas, Carlisle, England, assignor to Scottish Dyes, Limited, Carlisle, England.—1,504,164.

Manufacture of Quinizarine and the Like. John Thomas, Carlisle, England, assignor to Scottish Dyes, Limited, Carlisle, England.—1,504,165.

Coating Composition. Lyndon D. Wood, Bala, Pa., assignor to Fototone Co., Inc., Rochester, N. Y.—1,504,175.

Process for the Production of Ethers of Carbohydrates. George Young, London, England, assignor of one-third to Augustus Dacre Lacy, and one-third to Richard Charles Denington, both of London, England.—1,504,178.

Roll for Paper-Manufacturing Machines. Paul W. Bidwell, Easthampton, Mass., assignor to B. F. Perkins & Son, Inc., Holyoke, Mass.—1,504,179.

Books Recently Received

Resources of the British Empire

CHEMICALS. By *A. W. Ashe* and *H. G. T. Boorman, A. I. C.* With a foreword by *H. R. H. the Prince of Wales, K. G.* and general introduction by the *Right Hon. Sir Eric Geddes, G. C. B.*, president of the Federation of British Industries, *Sir Max Muspratt, Bart.*, vice-president of the Federation of British Industries and chairman of the Association of British Chemical Manufacturers, and *Robert Grosvenor Percy, C. B. E.*, chairman of the National Sulphuric Acid Association. 207 pages. Ernest Benn, Ltd., London. Price, 21s.

FERROUS METALS. By *M. S. Birkett*, of the National Federation of Iron and Steel Manufacturers. With a foreward by *H. R. H. the Prince of Wales, K. G.*, and general introductions by the *Right Hon. Sir Eric Geddes, G. C. B.*, and *Arthur Dorrman*, president, National Federation of Iron and Steel Manufacturers. 165 pages. Ernest Benn, Ltd., London. Price, 21s.

NON-FERROUS METALS AND OTHER MINERALS. By *N. M. Penzer, M. A., F. G. S., F. R. G. S.* With an introductory review by *Sir Richard Redmayne, K. C. B.*, chairman, Imperial Mineral Resources Bureau. 264 pages. Ernest Benn, Ltd., London. Price, 21s.

These three volumes are representative of a series of twelve self-contained surveys of the resources of the British Empire, prepared in non-technical language for the information of business men throughout the world. They are of particular interest in connection with the British Empire Exposition. Uniform with these three are others covering: Food supplies; timber and timber products; textile fibers and yarns; fuel; rubber, tea, cacao and tobacco; leather; oils, fats, waxes and resins; communications.

Each volume constitutes a business man's guide to a group of British, Dominion and Colonial products, giving particulars of quantities and qualities available and required in the different Empire markets, with details as to transport facilities, undeveloped resources, foreign competition and prospective variation in supp'y and demand.

Thorpe's Dictionary

DICTIONARY OF APPLIED CHEMISTRY. By *Sir Edward Thorpe*, assisted by eminent contributors. Vol. V, revised and enlarged, covering Oxygen to Rye, 722 pages, illustrated. Longmans, Green & Co., New York and London. Price, $20.

Within the range covered by this latest volume of the new editions are many industrial products of wide interest: Paints; paper; paraffine; petroleum; phenol; pigments; pitches; pottery and porcelain; refractories; resins; rubber.

Comparison of the space allotted to various subjects develops some interesting contrasts. Over 50 pages is devoted to photography and while no one will begrudge a thorough treatment of this interesting subject, the futility of attempting to cover such a vital chemical engineering industry as paper in 8 pages is made even more painfully evident by this contrast. It might be held that in such a highly technical industry as paper reference should be made to the special treatises available but this view would apply with equal weight to photography. In a work of this character, the reader may reasonably expect to find fairly detailed information on important industries in which chemistry plays a major part.

Technical Analysis

TECHNICAL METHODS OF CHEMICAL ANALYSIS. By *G. Lunge* and *C. A. Keane*. Second edition, edited by C. A. Keane and P. C. L. Thorne. Vol. I, 702 pages, illustrated. D. Van Nostrand Co., New York. Price, $18.

The new edition of Lunge and Keane will be published in six separate volumes, of which this is the first, each with its own index and appropriate reference tables at the end. Arrangement of the contents has been so modified that each contributor may be entirely responsible for his own subject. Many sections have been largely rewritten, several new sections have been added and the whole has been brought up to date.

Vol. I covers: general methods, with new sections on electrolytic and physical methods; sulphurous acid; sulphuric acid; saltcake and hydrochloric acid; sodas; liquid carbon dioxide; chlorine; and cyanogen compounds.

Metallurgical Investigations and Abstracts

JOURNAL OF THE INSTITUTE OF METALS, Vol. XXX. Edited by *G. Shaw Scott, M. Sc.*, Secretary. 838 pages, illustrated. Published by the Institute of Metals, London.

The first 407 pages are devoted to Dr. Rosenhain's May Lecture on "The Inner Structure of Alloys" and to sixteen papers on non-ferrous metallurgy presented at the annual autumn meeting, Manchester, September, 1923. The remainder of the book contains classified abstracts of papers relating to the non-ferrous metals and their respective industries.

JOURNAL OF THE IRON AND STEEL INSTITUTE. Vol. CVIII. Edited by *George C. Lloyd*, Secretary. 534 pages, illustrated. Published by the Iron and Steel Institute, London, and by Spon & Chamberlain, New York.

Fifteen papers presented at the September, 1923, meeting, held by invitation of the Italian Metallurgical Association at Milan, will be found in this volume, together with an account of the visits and excursions made in connection with this meeting. Part II contains, as usual, notes on the progress of British and foreign iron and steel industries as reported in the proceedings of scientific and technical societies and in the technical press.

Photographic Investigations

ABRIDGED SCIENTIFIC PUBLICATIONS FROM THE RESEARCH LABORATORY OF THE EASTMAN KODAK CO., Vol. VI. 238 pages, illustrated. Eastman Kodak Co., Rochester, N. Y.

Thirty research studies on the theories and mechanism of photographic processes are included in this volume. It presents an interesting picture of the trend of research in this field.

Industrial Relations

THE PERSONAL RELATION IN INDUSTRY. By *John D. Rockefeller, Jr.* 149 pages. Boni and Liveright, New York. Price, $1.75.

Promoting the co-operation of Labor and Capital may be regarded as the most vital problem of modern civilization. This idea is the basis of the addresses that have been brought together to form this book. Mr. Rockefeller expresses the purpose of these addresses as follows: "Legislation of itself will never solve the industrial problem. Its solution can be brought about only by the introduction of a new spirit into the relationship between the parties in industry—the spirit of co-operation and brotherhood. It is this theme, co-operation in industry, that I desire to develop."

Organic Preparations

SYSTEMATIC ORGANIC CHEMISTRY. By *William M. Cummin, I. Vance Hopper* and *T. Sherlock Wheeler*. 535 pages, illustrated. D. Van Nostrand Co., New York. Price, $6.

Following an introductory section on general methods, Part II is devoted to complete directions for the preparation of nearly 500 organic compounds. Part III covers qualitative and quantitative methods.

EXPERIMENTAL ORGANIC CHEMISTRY. By *James F. Norris*, professor of organic chemistry, Massachusetts Institute of Technology. 219 pages, McGraw-Hill Book Co., New York. Price, $1.50.

In preparing a second edition of the laboratory manual to accompany the revised edition of the author's textbook, advantage has been taken of the opportunity to give improved directions for a number of the experiments and to incorporate new material.

Chemical Calculations

CHEMICAL CALCULATIONS. By *J. S. Long, Ph.D.*, associate professor of inorganic chemistry, Lehigh University and *H. V. Anderson*, assistant professor of chemistry, Lehigh University. 166 pages, McGraw-Hill Book Co., New York. Price, $1.50.

This text carries the student through such calculations as maximum theoretical temperature of combustion, mass action and solubility product. It contains a total of 512 problems.

News of the Industry

Summary of the Week

Consuming trades present briefs in opposition to proposed placing of refined nitrate of soda on dutiable list.

Automatic reduction in duties on coal-tar dyes, next month, is expected to curtail domestic production of vat dyes.

Official announcement has been made of the forthcoming consolidation of the Congoleum Co. and the Nairn Linoleum Co.

Reports from France state that one-half the potash mines of Alsace are now operating under private ownership and one-half under government ownership.

Domestic producers of cement have asked for the application of the anti-dumping law against importations of cement.

Scientists to gather at Franklin Institute from Sept. 17 to 19 to celebrate centennial as well as inauguration of Bartol Research Foundation.

Fire destroys 45,000,000 lb. of powder at Old Hickory plant without causing loss of life. Cause of conflagration not ascertained. Nearby plants not injured.

Johns Hopkins announces a new course in gas engineering sponsored by Southern Gas Association.

Reduction in Duty Will Affect Production of Vat Dyes

When the automatic reduction of 15 per cent in the duties on coal tar dyes, colors and stains becomes effective five weeks hence, that portion of the dye industry least able to withstand the blow will be hit. By reducing the ad valorem rate from 60 to 45 per cent, it naturally is the high-priced dyes that suffer. For instance, a reduction of 15 per cent does not have the same relative effect on sulphur colors selling for 30c. a pound as it does on a vat dye worth $10 a pound.

No other branch of the chemical industry is more in need of protection, it is pointed out, than is vat dye manufacture. It is the manufacturers of these dyes who must be relied upon to blaze the trail to American color independence. That they have accomplished much is admitted, but Congress laid down an impossible task when it asked American chemists to duplicate in 2 years a 50 year research program. Research during this time has been conducted with feverish activity, but it is a type of activity that can not be put on a time-clock basis.

The operation of this law is to penalize the manufacturers who have made the country 95 per cent self sufficient in color production, rather than to reward them. How well they have succeeded is indicated by the July import figures, which also reveal that the hole in the dyke is constituted by a few vat dyes. The leading five dyes imported in that month all were vat dyes and made up more than one-third of the July imports. Two of those vat dyes made up 20 per cent of the total imports for the month.

Certain of the manufacturers who did not embark on a vat dye program now are congratulating themselves, but it is pointed out that those who made the effort, even if they find they can not continue to produce in the face of the competition which the lower rates will make possible, will at least have the very great satisfaction of knowing they did the patriotic thing and did their best toward the accomplishment of a task which Congress made all but impossible.

Powder at Old Hickory Plant Makes Immense Fire

Forty-five million pounds of powder burned at the Old Hickory plant near Nashville, Tenn. on Aug. 10 making the fire the biggest power conflagration in history. The fire was largely confined to the area reserved by the Government for powder machinery and storage purposes so that very little of the equipment belonging to the Nashville Industrial Corporation was damaged. The business of this concern in equipment sales is going on without interruption.

The war time value of the powder was close to 50 cents a pound although it is worth only about 1 cent at present. The machinery and buildings destroyed cost the government over $5,000,000.

Despite the extent of the fire that swept over 40 acres, no serious explosions occurred nor were any lives lost.

The flames originated in Solvent Recovery House 8, in the northeast end of the powder storage area, and leaped from building to building until finally they died out. The powder house, considered the most valuable building of the plant, escaped the flames by a scant twenty yards.

The numerous factories which have been converted or built since the war were not burned. The du Pont fiber silk mills, being built at a cost of $3,000,000 are about half a mile from the fire.

Changes in Ownership of Alsace Potash Mines

It is now made known that of the various potash mines of Alsace, one-half are to be operated by their private owners and the remainder, on the basis of 200,000,000 francs to be paid in 20 years, have become the property of the French government. Judgment was given to this effect by the Mulhouse tribunal on April 24th and later ratified by agreement with the ministry at Paris. This ends the transitory regime under which the mines were worked since the armistice.

The Alsace potash basin is now divided into two virtually equal parts, one in private hands and the other the property of the state. The two groups are working together through a common selling organization known as the Société Commerciale des Potasses d'Alsace, which will divide orders according to a common agreement.

In spite of the vicissitudes of the transition period, except during the year 1921, production has increased rapidly over what it was when the mines were in German hands. The greatest production of the five years before the end of the war was that of 1913—350,000 metric tons. The year after the war, 1919 there were extracted 592,000 tons; in 1920—1,221,513 tons; in 1921—903,134 tons; in 1922—1,326,726 tons, and in 1923—1,577,736 tons. During the course of the first 6 months of 1924 there were produced 840,810 tons.

Possibilities of extraction are greatly in excess of results produced in any single year to date. The Sainte Thérèse mine with four shafts can produce 2,000 tons per day which can be further increased if required, to 2,400 tons. The former sequestered mines can produce 9,000 tons per day.

Import Duty on Nitrate of Soda Doubtful

Consumers Offer Strong Opposition to Proposed Tariff on the Refined Product

Briefs which have been submitted the Treasury Department in connection with the question of the proper classification of refined sodium nitrate have been taken under advisement by classification experts of the Customs Division. As they will be sent to appraising officers at several ports for study, in addition to their consideration at Washington, it may be several weeks before a decision is reached.

Those interests which take the position that both the language of the act and the intent of Congress are such that all forms of sodium nitrate should be admitted without duty are believed to have reason to feel encouraged that their views will be accepted.

When their attention was first directed to the case, it was generally believed that the classification experts were inclined to hold that only crude nitrate was entitled to free entry, which would mean that the refined would be classified under Paragraph 5 of the Tariff Act of 1922 as a chemical salt not specially provided for, dutiable at 25 per cent ad valorem. Further study, and arguments presented in briefs opposing a ruling of this character, however, are considered to have changed this opinion, or at least to have placed the matter in considerable doubt.

The principal argument in opposition to declaring refined sodium nitrate dutiable, aside from the fact that no tariff act ever has made nitrate in any form dutiable, hinges about the phrase "or salt cake" appearing in Paragraph 1667, which reads: "Sodium: Nitrate sulphate, crude, or salt cake, and niter cake." Inasmuch as "or salt cake" obviously refers only to sulphate and not to nitrate, it is contended that the word "crude" qualifies only sulphate also, and has no reference to nitrate. If this construction were adopted, then all forms of sodium nitrate would continue on the free list.

In the brief submitted by the National Fertilizer Association and by the Manufacturing Chemists Association it was stated:

"Clearly it was the intention of Congress to have 'crude' modify 'sulphate' and only 'sulphate.' The natural reading of Paragraph 1667 leads to the conclusion that it was intended to limit free imports of sodium sulphate to the 'sulphate, crude,' or 'salt cake,' which by common acceptance are synonymous terms. For example, in Consolidated Freight Classification No. 3, at page 380, last paragraph, prescribing minimum carload rate, there is used the following language: 'Salt cake (crude sulphate of soda): in bags or barrels LCL in packages or in bulk CL, minimum weight 40,000 lb.'

"Congress employed the exact terms, and the only terms that could be employed to carry out its intent, namely, that 'sulphate, crude,' or 'salt cake,' should be admitted free. In the terms used for this description Congress followed the customary trade nomenclature and couple with the words 'sulphate, crude' the corresponding term 'salt cake.'

"Our position that 'crude' modifies only 'sulphate' is further strengthened by consideration of the conjunction 'or.' Applying the fundamental rule of grammar we are forced to parse 'salt cake' as in opposition with 'sulphate, crude,' and such it must be conceded was the understanding of Congress. If the conjunction 'or' has not this relation in the paragraph then it has no place of value there and could have been dropped and a comma used.

"Furthermore Congress had provided in Paragraph 83 of the Act for a duty of $2 per ton on 'sulphate, anhydrous' (note the juxtaposition of the noun and the adjective, identical with 'sulphate, crude'). It was therefore, necessary to distinguish in the free list between the free form of the material, 'sulphate, crude,' or 'salt cake,' and the dutiable form, 'sulphate, anhydrous.'"

Breithut Submits Final Report

Dr. F. E. Breithut last week was in Washington to make his final report to the Department of Commerce in connection with the extended study of the dye situation in the principal European countries as a special commissioner of the Department. This concludes his assignment and his connection with the Department. With the opening of the fall term, Dr. Breithut will resume his post in the chemical department of the University of the City of New York.

Cement Producers Invoke Aid of Anti-Dumping Law

Domestic producers of cement, through their counsel, have filed a brief with the Treasury Department, setting forth that serious injury will result to the domestic industry unless a check is placed on importations from Denmark, Sweden, Norway, and Belgium. The brief states: "It has been shown that foreign cement is being shipped into the United States at prices below those at which it is sold for home consumption in the countries of Norway, Sweden, Denmark and Belgium, and that the domestic cement industry along both coasts in the United States, and in the American possessions of Hawaii and Porto Rico, have been, are being and are likely to be seriously injured by such shipments by reason of the loss of markets, forced reduction of prices in some instances to points where profits have vanished, the closing down of mills and the operation of others far below their capacity.

"It also has been shown that the domestic supply is amply sufficient to meet all demands, and that the prices resulting from keen domestic competition have been as low as could possibly be expected if a fair return is to be realized on the capital invested.

"The premises and facts considered, it is respectfully urged, that the department proceed to make such finding and issue such instructions to customs officers under the anti-dumping act as will afford the relief sought by the complainants and prevent further injury or likelihood of injury to the cement industries along the coasts by reason of the dumping of cement into the United States from any one or all of the countries of Norway, Sweden, Denmark, and Belgium."

Franklin Institute to Celebrate Centennial Sept. 17-19

The Franklin Institute is to celebrate its centennial Sept. 17 to 19. At that time a gathering of eminent scientists is to assemble at Philadelphia to take part in the celebration. In addition to the special events marking the occasion, the inauguration exercises of the Bartol Research Foundation will occur.

Delegates and guests will assemble at the hall of the Franklin Institute on the morning of Sept. 17. From here the academic procession will take place to the Walnut St. Theater, where addresses of welcome will be delivered by the Mayor, by W. C. Eglin, president of the Institute, and by Elihu Thomson, honorary chairman of the Celebration Committee. During the three-day period, meetings will be held at the hall of the Franklin Institute and at other appointed places. On Friday a tablet will be unveiled at the Bartol Research Foundation.

Many notable addresses are included in the preliminary program. On Thursday Sir Ernest Rutherford will talk on "The Natural and Artificial Disintegration of Elements." Prof. G. S. Jacobus will speak on "Stimulation of Research and Invention." Arthur L. Day, director of the Geophysical Laboratory of the Carnegie Institution, Washington, will have for his subject "Some Causes of Volcanic Activity." Prof. P. W. Bridgman, of Harvard, will talk on "Some Aspects of High Pressure Research," and Prof. Wilder D. Bancroft, of Cornell, will discuss "The Development of Colloid Chemistry."

"The Mercury Boiler" will be the subject of W. L. Emmet, of the General Electric Co. Prof. F. Haber, of Berlin, will deliver an address on "Technical Results of the Theoretical Development of Chemistry." Others of the speakers and their subjects are as follows:

Prof. Julius Stieglitz of the University of Chicago, "The Theory of Color Production in Organic and Inorganic Compounds."

Prof. C. H. Mathewson, of Yale: "The Trend in Physical Metallurgy."

Charles L. Reese, of E. I. du Pont de Nemours & Co.: "Twenty-five Years' Progress in Explosives."

Prof. Bradley Stoughton, Lehigh University: "Magnetic Analysis of Steel."

E. W. Rice, Jr., General Electric Co., Schenectady, "The Field of Research in Industrial Institutions."

Merger of Linoleum Companies

It was officially announced last week that plans had been completed for the merger of the Congoleum Co. and the Nairn Linoleum Co. Details of the consolidation will not be made public for a few days. Frank B. Foster, president of the Congoleum Co. is now on his way back from England after conducting negotiations with Sir Michael Nairn, president of the Nairn Linoleum Co.

Washington News

Dye Industry Has Utilized Aid of Chemical Division

Some criticism has been aimed at the Chemical Division of the Department of Commerce to the effect that a disproportionate amount of its efforts has been in behalf of the dye industry. The contention is that the other branches of the chemical industry are entitled to more attention than they have been receiving.

In defense of the conduct of the division, it can be said that the dye industry happens to occupy a position where the difficulties of entrenching itself are great. Not only has it been in urgent need of all the help it could get, but it has shown a marked degree of appreciation of the service which the Department could furnish. It has not waited for the Department to take the initiative. The industry has had a very definite idea as to the help the Commerce Department could furnish. It is the policy of all government bureaus to give priority to specific requests for assistance. It has happened that the dye makers have thought of 10 things to ask where other branches of the chemical industry have made but one request. One line of chemical activity has been very anxious to secure cost data in other countries. There are reasons why the Department of Commerce should not enter upon that type of activity. The government must confine itself to the thoroughly ethical types of trade promotion. It is true that the Customs Division of the Department maintains representatives abroad who gather figures as to costs of production, but those figures are for the confidential use of the customs authorities and never are made public. The unpopularity of these officials gathering confidential information gives an inkling of what would happen were there to be a governmental effort to ferret out foreign costs for the use of American manufacturers. The collection of foreign cost figures by the Tariff Commission is confined largely to a few cases under investigation.

If any branch of the industry will confine its requests to the activities which the Division properly may undertake, it can be taken for granted that an earnest effort will be made to carry out the assignment. While there are certain endeavors in which a government bureau may take the initiative and act as a leader for industry, it is dependent in large part upon suggestions from the industry as to the service which would be most helpful.

Chemical and Dye Combination Successful in France

The fusion of the Compagnie Nationale de Matières Colorantes and the Etablissements Kuhlmann somewhat less than a year ago has resulted in a distribution of profits of 22,000,000 francs.

The production of superphosphates was 370,000 tons, an increase of 16 per cent over the year before; of acids, sulphates and bleaching products 420,000 tons, an increase of 50 per cent. Colors and dyes, of many varieties, reached an output of 5,940 tons, equaling 80 per cent of the consumption of France. A new side line of manufacture established during the year was that of artificial silk and synthetic acetic acid and experiments were carried out looking to the production of nitric acid by like methods.

The companies have 50,000,000 francs in reserve which are to be employed as may be needed in the future. The Chairman of the board of directors states also that a working arrangement may be arrived at with the German industry later on, though as yet no accord had been completed. With respect to its export business the statement was made that the company was able to more than successfully compete in world markets with that of America, Germany and England. Eighty chemical engineers are employed by the company in its research department.

Food Standards To Be Discussed

The joint committee on definitions and standards will hold its twenty-sixth meeting in the Bureau of Chemistry, Aug. 18-22, inclusive, according to an announcement by Dr. W. W. Skinner, chairman of the committee. Proposed standards for ice cream, meat and meat products, wheat flour, jams, and jellies will be discussed.

The joint committee is composed of nine members, three representing the Association of Official Agricultural Chemists, three representing the Association of American Dairy, Food, and Drug Officials, and three the United States Department of Agriculture. This committee recommends definitions and standards for food products for the guidance of Federal and State officials in the enforcement of food laws.

Petroleum Exports Gain During Fiscal Year

Exports of petroleum and its major products from the United States during the fiscal year ended June 30 amounted to 4,428,110,720 gal., compared with 3,373,027,993 gal. in the preceding fiscal year. Gasoline shipments were responsible for 23 per cent of the total increase of 31.2 per cent. Increase in value of oil exports was only 9.9 per cent, due to generally lower prices.

The imports of petroleum products in the 1924 fiscal year showed a decrease of 5 per cent from the preceding period, totaling 4,249,000,000 gal. Gasoline imports were 195,000,000 gal. Practically all of the oil imported came from Mexico.

A feature of the oil exports was the much larger trade with the United Kingdom, which purchased 297,000,000 gal. of gasoline from the United States, or 74.4 per cent more than in the preceding 12 months, despite larger supplies for the British refineries. France was the second largest purchaser of American gasoline, taking over 270,000,000 gal., with Canada third and Germany fourth.

New German Cocaine Reported

Inquiry is being made by the Chemical division of the Department of Commerce as to the authenticity of the report that the Merck's Chemical Works at Darmstadt, Germany, has developed a synthetic cocaine which does not possess a habit-forming character. If such a discovery has been made, it is pointed out, its importance is sufficient to have justified front-page attention of the newspapers of the world, rather than the obscure mention given the matter in foreign chemical journals.

Increased Shipments of Manganese Ore in 1923

More manganese ore was shipped in the United States in 1923 than in 1922, according to figures prepared by the Geological Survey. Although the shipments increased more than two and one-third times—from 13,404 gross tons in 1922 to 31,500 gross tons in 1923—they were smaller than many expected that they would be under the stimulus of the tariff on manganese ore.

The average values per ton of the ore imported from Germany in 1922 ($90.22) and from Germany and England in 1923 ($100.37 and $126.74, respectively) are near the prices received for ferromanganese and are considerably above those received for manganese ore. It is therefore probable that the imports from those two countries reported as manganese ore represent, in part at least, some other material. The average value of all reported imports of manganese ore in 1923 was $18.80 a ton.

Low Imports A Feature

Imports in 1923 were the smallest since 1911 and were less than half those in 1918, when the domestic production was nearly ten times as great as in 1923. Consequently domestic production plus imports in 1923 (238,000 gross tons) was less than one-third of production plus imports in 1918 (797,000 gross tons). These figures, however, do not indicate a decrease in the requirements for manganese in 1923. Most of the manganese ore consumed in the United States is employed in making ferromanganese and spiegeleisen, which are used in the manufacture of steel, and the steel produced in 1923 amounted to 44,943,696 gross tons as against 44,462,432 gross tons in 1918, and, except the production in 1917 (45,060,607 gross tons), was the highest ever recorded. Large stocks of manganese ore were accumulated in the United States prior to September 22, 1922, when the tariff on manganese went into effect, and the large imports of ferromanganese in 1922 and 1923 made possible the great production of steel stated with so low a total domestic production plus imports of manganese in 1923.

News in Brief

Italy Has Chemical Exposition—The first exposition of its kind to be held in Italy showing chemical products of thirty different groups will be held in Turin, Italy, during the months of September and October of this year under the auspices of several Italian Chemical Associations, according to a report to the Department of Commerce from Assistant Trade Commissioner J. A. Palmer, Rome.

Philipsburg, Pa., Refractories Plants Resume Activity—The Harbison-Walker Refractories Co., Pittsburgh, Pa., manufacturer of fire brick and refractory shapes, has resumed operations at its plants at Monument and Retort, both in the vicinity of Philipsburg, Pa., giving employment to about 250 men. A number of improvements have been made at the first noted plant during the period of curtailment, making it one of the most complete and efficient works of the company, which operates a total of 28 plants in different parts of the country. It is expected to develop maximum production at both of the properties at an early date.

Pyrotol Being Disposed of—The Bureau of Public Roads has completed arrangements to distribute 100,000,000 pounds of pyrotol to State highway commissions and farmers. Pyrotol is composed largely of ground smokeless powder which has been prepared by a method perfected by George R. Boyd, of the Bureau of Public Roads. It will be prepared for shipment at Repauno, N. J., Barksdale, Wis., and Du Pont, Wash.

Arsenic Ore Found on Vancouver Island—What is regarded as a valuable discovery in minerals has been reported by Ewen Morrison, a British Columbia prospector of many years standing. He has located a large ledge of realgar on Vancouver Island in the Comox district. Severe tests have disclosed a content of arsenic of 56.2 per cent in the sample submitted. The sulphur content has not yet been determined.

Rubber Plants More Active — The United States Rubber Co., has resumed production at its mills at Woonsocket and Millville, R. I., following a shutdown of about 5 weeks. Approximately 1,800 employees will return to work. The company will also place the wire plant of the National India Rubber Mill, Bristol, R. I., a subsidiary organization, on a full production basis at an early date, giving employment to 270 operatives, with a wage reduction of about 8 per cent. Other mills, now closed down or on a curtailed schedule, are expected to be placed on the active list within the next few weeks.

Mineral Paint Pigment To Be Developed—A large and pure deposit of mineral paint pigment has been discovered in the vicinity of Arkona, which is midway between London and Windsor, Ont. The Lampton Paint Products Co. of Windsor has been formed with P. A. McKee of Windsor as president, and will commence operations at once. It is said to be the only supply of mineral paint pigment east of the Mississippi River.

Lehigh Cement Plants Running Full—Practically every cement mill in the Lehigh Valley district of Pennsylvania is running at full capacity, with the employment of a full working force. Incoming orders for early fall delivery are said to insure the present basis of operation for a number of weeks to come. August shipments from the mills are expected to duplicate the July output, when about 4,000 carloads left the plants. This is an increase of close to 1,000 carloads over the corresponding month of July a year ago. A few of the plants, including that of the Atlas Portland Cement Co., at Northampton, reached close to record shipments for the month noted.

Chinese Are Developing Domestic Manufacture of Glass

Glass manufacturing has been known in China since time immemorial but the methods adopted by Chinese glass makers are crude and consequently the output is limited. At the beginning of this century several modern glass factories sprang into existence; most of these concerns, however, were failures.

So far the output of the Chinese factories has been almost confined to glassware. For plate glass China still depends largely on foreign countries. Some years ago a Russian manufacturer established a factory in Manchuria to turn out window panes for the Chinese Eastern Railway. The bulk of glass plates consumed in China is imported from Belgium and Japan. North China has a greater demand for glass plates than the South, probably owing to climatic conditions. In North China Japanese importers have a predominant influence, and the recent attempt of Chinese industrialists to develop the manufacturing industry in the northern province has caused no little anxiety to Japanese manufacturers.

The Kai-Lun Mining Company has recently organized the Yao Hwa Glass Factory in the neighborhood of Chinwangato with a capital of $1,000,000. The promoters at first intended to use the sand from the Chinwangtao harbor for manufacturing, but after experiment it was found to contain too much iron for the purpose and they decided to use the river sand at Tang Ho, near Chinwangtao. The chief advantage for manufacturing in this neighborhood is the cheapness of fuel, which can be obtained from the neighboring coal mines at about $4 a ton.

The Japanese are planning a glass factory in Manchuria which will utilize the cheap fuel supplied by the Fushun coal mines. The project has been under consideration by the South Manchuria Railway Company for years and is expected to materialize in the near future.

Johns Hopkins Offers New Course in Gas Making

A new course in gas engineering, sponsored by the Southern Gas Association, but open to all qualified applicants, is to be given in Johns Hopkins University, Baltimore, beginning Sept. 30, 1924.

This course has as its primary object the offering of instruction in the field of gas engineering to graduate students who have taken the necessary preparatory studies in mathematics, physics, chemistry, and mechanical engineering. Such students will take further courses in chemistry, mechanical engineering, and in other subjects related to the gas industry, as for example, gas manufacturing and distribution, fuels and gases, refractories, and the like, together with laboratory and research work. Graduate students with the requisite preparatory training should be able to complete this course in two years.

Undergraduate students will be admitted to a four-year course in gas engineering. The courses of the first two years will consist largely of those found in the courses in electrical and mechanical engineering and in chemistry. The professional courses bearing directly on the field of gas engineering are placed in the third and fourth years. Students completing these courses will receive the degree of Bachelor of Engineering, and will be encouraged to go further in the field of advanced study and research.

The courses will be accompanied by laboratory work. Ample facilities for undergraduate instruction are provided in a separate laboratory building and in connection with the steam power station. The research laboratory is equipped with gas holder, retorts, apparatus for the recovery of by-products from coal combustion, and for other allied problems.

The gas by-products laboratory is very nearly a complete plant and is available for research work for students desiring to follow gas engineering. It includes a 400-pound retort, hydraulic main, condensers, tar extractor, scrubbers, purifier, tar and ammonia tanks, and gas holder. Meters, gas analysis apparatus, and calorimeters are also available. Some valuable investigations have already been made with this equipment.

Arrangements have also been made for taking advantage, for the purpose of instruction and experiment, of the plants of several large gas industries in and around Baltimore.

Germans Interested in Cyanide Manufacture From Sugar

German interests connected with the manufacture of cyanide as a by-product of sugar refining are investigating the situation in the United States to ascertain the advisability of undertaking such manufacture in this country. With the rise of flotation, there has been a decrease in the amount of cyanide used in the treatment of gold and silver ores but there has been a marked increase in its use as an insecticide.

Trade Notes

Oscar S. Flash, secretary of the Edward Flash Co., brokers in cottonseed and other vegetable oils, at New York, died on August 9. Mr. Flash was widely known in the vegetable oil trade. He was formerly associated with the Southern Cotton Oil Co. and later with the American Cotton Oil Co. He was an active member of the New York Produce Exchange and the Oil Trades Association.

R. K. Williams has severed his connections with the New York office of Ellis Jackson & Co., his resignation having been accepted as of Aug. 4.

Frank W. Lyman has been elected vice-president and director of the American Glue Co. Mr. Lyman had been connected with Armour & Co. for the past 12 years.

The Bob White Chemical Co., which had a factory in Ogdensburg, N. Y. and offices in New York City, has been dissolved.

Caleb E. Johnson, president of the Palmolive Soap Co., died at East Hampton, N. Y. on August 8.

By a resolution of May 28, formic acid has been added to the list of raw materials on which a duty of 10 per cent ad valorem is imposed, when imported into Peru for industrial purposes in quantities exceeding 500 kilos.

M. De Matia Chemicals, New York City, announces that S. Politi has joined that company and has been elected secretary.

The plants of Georgas-Pierie Mfg. Co., crushers of copra, and of the Bisbee Linseed Oil Co., at Philadelphia, were badly damaged by fire on August 8.

Production of Oils and Fats in Second Quarter

The Department of Commerce announces that the factory production of fats and oils, exclusive of refined oils and derivatives, during the 3-month period ended June 30, was as follows: vegetable oils, 350,344,362 lb.; fish oils, 6,899,682 lb.; animal fats, 635,610,183 lb.; and greases, 102,204,064 lb.; a total of 1,095,058,291 lb. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 525,-548,447 lb., appears for edible and neutral lard. Next in order is linseed oil with 176,186,954 lb.; tallow with 107,931,563 lb.; cottonseed oil with 95,-540,375 lb.; coconut oil with 38,566,469 lb.; and corn oil with 26,663,472 lb.

The production of refined oils during the period was as follows: cottonseed, 165,065,510 lb.; coconut, 37,196,771 lb.; corn, 22,500,718 lb.; peanut, 1,753,253 lb.; soya-bean, 362,525 lb., and palm-kernel, 162,653 lb. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

Italy May Increase Duties on Ammonium Compounds

By Royal Decree issued in July, 1923, the government of Italy is given the authority of including a coefficient of three in regard to the import duty on ammonium sulphate and ammonium nitrate, according to a report to the Department of Commerce from Assistant Trade Commissioner James A. Palmer, Rome. The existing duty on both ammonium sulphate and ammoniun nitrate is one gold lira per quintal. Should the government decide to apply the coefficient of three the duty on both ammonium sulphate and ammonium nitrate will be increased to four gold lira.

Titanium to be Produced On Commercial Scale

A new method of reducing refractory ores of some of the rarer metals has been developed by Simon J. Lubowsky of the Metal and Thermit Corporation. The method is applicable on a commercial scale and is expected to make

Simon J. Lubowsky

commercially available several metals which have heretofore been laboratory curiosities. The development of the process for producing titanium has been carried to completion and will be described in the near future in a technical paper by Mr. Lubowsky.

Increase in Wood Oil Trade of Hankow

In a report from Hankow, Consul General P. S. Heintzleman says the 12 months of 1923 witnessed a large increase in Hankow's wood oil trade. The demand from abroad continued brisk throughout the year, which again was a record one for the trade. The increase in the quantity exported was not as marked as the advance in value, due to the high prices prevailing. Wood-oil shipments from Hankow in 1923 aggregated 18,356,320 gal., valued at $18,614,183, an increase from an exportation of 17,402,293 gal., valued at $11,297,008, in 1922 and 11,936,333 gal., worth $6,575,417, in 1921. The export trade to the United States recorded an expansion from 9,500,041 gal. in 1922 to 10,382,588 gal. in 1923, the total declared values of shipments being $7,864,064 and $13,765,487, respectively. The corresponding figures for 1921 were 4,151,892 gal. and $3,135,160.

An interesting feature of this trade is the diminishing importance of the barrel as a container; nearly all large shipments are now made in bulk, and, as a result, many of the firms ship in tank steamers. During the high-water season—April to October—some of these vessels load at Hankow; at other seasons the oil is transported by bulk-oil lighters to Shanghai where it is transshipped into ocean steamers. Three firms in Hankow have established pipe lines from their warehouses to the river front, thus greatly facilitating the handling of the product.

The crop of wood oil nuts in 1923 was good in both quantity and quality, and the harvest yielded about 40,000 tons of oil for export. The prospects for 1924 in this trade are considered good.

Financial

The U. S. Gypsum Co. has declared an extra dividend of 1 per cent on common and regular quarterly dividends of 1 per cent on common and 1¾ per cent on preferred.

For 6 months ended May 31, the Freeport Texas Co. reports surplus of $158,789 after charges, taxes and depreciation, equal to 21c. a share earned on the 729,844 shares of no par capital stock, as compared with surplus of $544,056, or 74c. a share, in first half of previous year.

The Sherwin-Williams Co. of Canada has declared regular quarterly dividends of 1½ per cent on the common and 1¾ per cent on the preferred.

A report from London states that the British Oil & Cake Mills, Ltd., operated at a profit in the first 6 months of this year but the directors decided to postpone action on dividends until the close of the year.

For the 6 months ended June 30, the Barnet Leather Co., Inc., reports deficit of $15,911 after expenses, depreciation and federal taxes against net income of $57,927 in first halfe of 1923. After preferred dividends and sinking fund provisions there was a deficit of $68,411 compared with deficit of $51,573.

Consolidation of the Marine Oil Corporation, the Marine Drilling Corporation, the Western States Oil Co., Coastal Oil Corporation, Colonial Oil Co. and the Cardinal Corporation, all operating in the Signal Hillfield, has been made public by officials of the Marine Oil, which heads the $5,000,000 merger.

Men You Should Know About

E. A. ASHCROFT of London is at the Plaza in New York. He expects to spend some time in the United States on business.

S. M. BARNET, head of the Barnet Leather Co., New York, with tannery at Little Falls, N. Y., and president of the Calf Tanners' Association, will soon sail for Europe, accompanied by his wife and son, for an extended tour of the continent. He will investigate tannery conditions, wage scales, etc., in co-operation with several United States Government investigators now abroad for information for tariff legislation to assist the calf tanners.

A. C. BEDFORD, chairman of the board of directors of the Standard Oil Co., of New Jersey, has returned from Europe after an absence of several weeks.

Dr. S. S. CAMERON, permanent head of the Department of Agriculture, Government of Victoria, Australia, is on a visit to the United States to obtain information regarding the beet sugar industry, making his headquarters at San Francisco, Cal.

T. LINSEY CROSSLEY, chemical engineer, of Toronto, Ontario, is acting as editor of the *Pulp and Paper Magazine of Canada* during the absence in England of J. N. Stephenson. Mr. Crossley is also conducting a department of "Dyeing and Finishing" which was recently inaugurated by *The Canadian Textile Journal.*

C. F. W. DILLOWAY, treasurer of the Indian Refining Co., Lawrenceville, Ind., has resigned.

F. B. FOSTER, president of the Congoleum Co., New York, has sailed for London, England, on a business trip for his company.

GEN. AMOS A. FRIES, head of the Chemical Warfare Service, and H. W. Walker, a member of his chemical staff, are in the South to visit the state laboratory at Experiment, Ga., and the Department of Agriculture laboratory at Tallulah, La., where experiments will be conducted in the use of poison gas in boll weevil control.

Calendar

AMERICAN CERAMIC SOCIETY, Los Angeles, Cal., Oct. 6 to 7.

AMERICAN CHEMICAL SOCIETY, sixty-eighth meeting, Cornell University, Ithaca, N. Y., Sept. 8 to 13.

AMERICAN ELECTROCHEMICAL SOCIETY, Detroit, Oct. 2 to 4.

AMERICAN FOUNDRYMEN'S ASSOCIATION, Milwaukee, Wis., Oct. 11 to 16, 1924.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, Pasadena, Calif., Oct. 13 to 17.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, Birmingham, Ala., Oct. 13 to 15.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. New York, Dec. 1 to 4.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, New York, Dec. 1 to 3.

AMERICAN SOCIETY FOR STEEL TREATING, Boston, Sept. 22 to 26.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Toronto, Aug. 6 to 13.

FRANKLIN INSTITUTE CENTENNIAL. Philadelphia, Sept. 17 to 19.

MANAGEMENT WEEK. Auspices of American Society of Mechanical Engineers, New York City, Oct. 20 to 25.

NATIONAL SAFETY COUNCIL, Louisville, Ky., Sept. 29 to Oct. 3.

PACIFIC COAST GAS ASSOCIATION, Santa Barbara, Calif., Sept. 15 to 19.

EUGENE GRACE, president of the Bethlehem Steel Corp., Bethlehem, Pa., has returned from a trip abroad.

HERBERT HOOVER, Secretary of Commerce, Washington, D. C., is the recipient of a degree of doctor in economics and social science from the University of Louvain, Belgium, in recognition of his services in the capacity of chairman of the commission for relief in that country.

Dr. WLBERT J. HUFF is to take up his new work as professor of gas engineering at Johns Hopkins University about September 1. Dr. Huff, who has been with The Koppers Co. research laboratories in Pittsburgh, is to be the first professor to occupy the chair of gas engineering which was created by the University with funds furnished through the Southern Gas Association. He will have a committee of this Association working in co-operation with his Department and the University.

Dr. ERIC R. JETTE, graduate of the Franklin and Marshall College, Lancaster, Pa., class 1918, has been awarded a fellowship for chemical research at Columbia University and appointed a member of the faculty with an instructorship in chemistry.

F. W. KELLEY, head of the Helderberg Cement Co., Albany, N. Y., and president of the Portland Cement Association, has sailed for Europe, to be absent several weeks. He will make an address at the convention of cement interests to be held in London early in September, commemorating the one hundredth anniversary of the invention of Portland cement. Mr. Kelley will visit and inspect a number of cement mills in England and on the continent to compare practices and methods of production.

ARCHIBALD MCCOLL, general manager of the British Empire Steel Corp. operations on the mainland; George D. MacDougall, chief mechanical engineer, and William G. Wilson, superintendent of mills, have all resigned, following a ten to twenty-five per cent cut in wages.

G. ST. J. PERROTT, associate physical chemist, Department of the Interior, on the staff of the Bureau of Mines, has been detailed to go to Pachuca, Mexico, where he will spend approximately two months observing methods employed in the use of liquid oxygen explosives in a silver-lead mine of the Compania de Real del Monte y Pachuca, a subsidiary of the United States Smelting, Refining and Mining Co.

SAMUEL R. RUSSELL, technical field expert for the high explosives division of E. I. du Pont de Nemours and Co., Wilmington, Del., tendered an interesting address before the members of the local Rotary Club, July 30, on the subject of dynamite and its uses in industry.

Dr. ANCEL ST. JOHN has resigned as research physicist from the staff of the Union Carbide and Carbon Research Laboratories, Inc., Long Island City, N. Y., and will open offices as a consulting and research physicist, specializing in the industrial application of X-rays. Recently Dr. St. John has been endeavoring through publications and lectures to give the steel industry an inkling of what X-rays have done and can do toward improving methods and products, and he believes that the time is opportune for making his training and experience more generally available, not only to the steel trade, but also to chemical and metallurgical industries. For the present Dr. St. John's mail address is Room 404, 505 Fifth Ave., New York, N. Y.

Dr. MAXIMILIAN TOCH, vice-president of Toch Brothers, New York, manufacturers of technical paints, varnishes, etc., has completed his series of lectures at the National Institute of Technology, Pekin, China, made on the invitation of the Chinese Government, and will return to the United States during the coming month. In recognition of his services to the Institute of Technology, he has had conferred upon him the title of Honorary Professor of Industrial Chemistry.

SAM TOUR, metallurgist of the Doehler Die-Casting Co., announces the removal of his headquarters from the Brooklyn to the Batavia, N. Y., plant. There will be no discontinuance of the work Mr. Tour has been doing, but it will be carried on at and directed from the new headquarters.

PAUL WEIL, managing director of the American Hide and Leather Co., Ltd., Northampton, England, will soon visit America on his annual tour of inspection of the American Hide and Leather Co. of the United States, an affiliated interest.

Obituary

Dr. GEORGE W. LACEA, of Rochester, N. Y., prominent in commercial chemistry, died at the home of his sister at Buffalo, on July 28. He was born in Bringhurst, Ind., in 1857 and graduated from the University of Michigan in 1887.

JACOB H. MOHR, superintendent of the Carrie furnaces of the Carnegie Steel Co., Rankin, Pa., was killed in an automobile accident, Aug. 4. In 1893 he was with the assistant chief chemist at the Homestead plant of the company and later became chief chemist at the Duquesne, Pa., plant. In 1905 he was made superintendent and held that position until his death.

WILLIAM T. MORGAN, vice-president and general manager of the Raymond Lead Works, Chicago, Ill., died in that city, Aug. 4, aged 67 years.

THOMAS WILFRED OWENS, chemist, employed by the Queens Run Fire Brick Co., was drowned recently at Lock Haven, Pa.

Market Conditions

Holders of Arsenic Press Sales in the Spot Market

Slow Call for Calcium Arsenate Weakens Confidence in Recovery of Values—Firmness in Metals Affects Derivitives

PROSPECTS for an active buying movement in calcium arsenate have failed to materialize and holders of arsenic have shown more of a disposition to liquidate stocks. Sales were reported last week at prices lower than were acceptable in preceding weeks. Interest increased as lower prices were established and developments in this material were classed among the features of the week's trading. Reports of boll weevil damage in the cotton-growing states are less prominent than they were last year and this may account for the disappointing call for calcium arsenate and the sluggishness of the arsenic market.

The metal markets have been gaining in strength and higher prices have had a stiffening effect on values for the metal salts. Lead oxides were marked up in price last week and other lead products while held at former levels show a firmer tone and may respond to the advance in the metal. Copper, tin, and zinc salts also are reported to be in a firm position.

Reports from Washington state that strong opposition has arisen to the application for an import on refined nitrate of soda. Consumers filed a brief giving their reasons for a continuance of this product on the free list and opinion now seems to favor a decision to that effect.

The position of the various industries which are consumers of chemicals has varied but little during the interval. The changes reported have indicated expansion of operations and a gradual improvement appears to have gained headway in manufacturing lines. This has been reflected in a better demand for chemicals and allied products though the increased buying movement has not yet assumed active proportions.

The weighted index number was higher last week. Gains were recorded in some of the miscellaneous chemicals but the main influence was again attributable to a rise in price for cottonseed oil. For this reason the advance in the weighted index number was larger than warranted by price changes in the purely chemical list.

Acids

While there are reports of a better call for sulphuric acid, values have not moved into higher ground and sellers of 66 deg. acid are still willing to do business at $13 in tank car lots. Lower grades of sulphuric are quiet with a buyers market still ruling. The outlook for consumption of fertilizer grades of acid is regarded as favorable because of the high prices maintained for cotton and incidentally because of the attempts to stabilize the fertilizer industry. Muriatic acid is also irregular in price with sellers eager to reduce surplus holdings. Nitric acid is said to be moving more freely but new business has not been heavy. The recent decline in tartaric acid has not stimulated inquiry and the preference remains with the imported material because of the price differential. Citric acid has sold below the seasonal standard and both importers and domestic producers have found the market disappointing. The higher grades of phosphoric acid are firmly held but the lower grades have been quiet with prices easy. Oxalic acid has failed to recover from recent low levels but sellers are asking a premium for small lots and sales were made last week at 9¾c. per lb. with large lots offered at 9½c. per lb.

Spot Arsenic Offered at Lower Prices — Cream of Tartar Higher — Limited Offerings Strengthen Values for Sulphate of Ammonia—Lead Oxides Advanced — Sal Ammoniac Lower for Shipment—Bichromates Quiet—Copper Sulphate Firmly Held—Sulphuric Acid Easy

Potashes

Bichromate of Potash — More encouraging reports have come from important consuming trades but call for bichromate has remained quiet. The present market is depressed by competition among sellers and values have been irregular. The prices openly quoted by some producers have been discarded in making sales and the current trading basis for round lots is placed at 9c. per lb. for domestic delivery with exporters able to shade that figure.

Carbonate of Potash—Moderate sized lots have been in demand and some reports credit a better trading movement. Values are holding a fairly steady level with calcined 96-98 per cent quoted at 6c. per lb.; 80-85 per cent at 5¼c. per lb.; and hydrated 80-85 per cent at 5¾c. per lb. Imports of carbonate for the fiscal year ended June 30, wer 8,049,814 lb.

Caustic Potash—Imported caustic in the spot market shows a range in price according to seller. There are offerings at 6½c. per lb. with other sellers holding out for 6¾c. per lb. The shipment market is also quoted at 6½c. per lb. Demand has been fair and in spite of reports to the effect that consuming demand has been quiet, it is evident that fairly normal amounts have passed to buyers.

Chlorate of Potash—A routine market is described for this material. Buyers are well covered ahead and a good part of arrivals from abroad pass direct to consumers. Trading in spot chlorate is quiet and the tone to values has been easy as a result of the quiet call. Quotations are on a basis of 6¾c. to 7c. per lb.

Permanganate of Potash — Supply and demand have been on a fairly even keel and while inquiry is still slow, offerings in sellers hands also are light and prices have been maintained. Firm bids at 13½c. per lb. are reported to have been made but were met with an inside price of 13¾c. per lb.

Prussiate of Potash—Red prussiate of potash is selling in a spasmodic way with most sellers quoting around 37c. per lb. This quotation can be bettered on actual business. Yellow prussiate is offered freely at 17½c. per lb. for forward deliveries and this has cut down interest in spot material which is held at 18c. per lb.

Sodas

Acetate of Soda—Rumors of sales at 4½c. per lb., at works, have been heard but in most cases sellers are quoting 4¾c. per lb. as an inside price for round lots and 5c. per lb. for smaller amounts.

Bichromate of Soda—Prices have remained easy as a result of activity on the part of some sellers. There has been no attempt to announce an open decline in the sales price but whenever desirable business comes into the market, prominent factors in the selling end offer special prices and sales are said to have been made at 6¾c. per lb. Open offers at 7c. per lb. have been heard and the latter is regarded as a price at which buyers of large lots can place orders.

Caustic Soda—Export buying is said to have been quiet and offerings are heard on a basis of 2.80@2.85c. per lb., f.a.s. While exports from this country have declined, those from England have gained in volume. Shipments from the latter country for the 6 months ended June 30, were 944,468 cwt., valued at £773,969 as compared with 799,293 cwt., valued at £701,918 in the corresponding period of 1923.

Demand for caustic for home consumption is said to be about normal with a moderate amount of new orders coming to hand. It is also stated that considerable business has been booked for future delivery at private prices. The contract price is still nominally quoted at $3.10 per 100 lb.

Fluoride of Soda—Offerings are in firm hands and while quotations of 8½c. per lb. have been heard for spot fluoride, the general quotation is 8¾@9c. per lb.

Nitrate of Soda—Chief interest is still confined to the settlement of the question of duty on refined nitrate of soda. Briefs were presented to the Customs Division last Monday in which consumers presented arguments to show that the present tariff grants free entry for this material. No decision has yet been made but it is reported that opinion has changed regarding the attitude of officials and hope is expressed that no change will be made in the import status of refined nitrate. Spot offerings of 95 per cent are held at $2.50 per 100 lb. with supplies still small.

Miscellaneous Chemicals

Acetone — This material has continued to hold a firm position. Scarcity of supplies of the fermentation product has tended to cut down competition and sales of acetone made from acetate of lime have been made at 16c. per lb. Asking prices for acetone range from 16c. to 17c. per lb. on a quantity basis the quotation being f.o.b. works.

Alum—Producers of ammonia alum are reported to have held their output down in recent weeks and while buying has not been heavy, there has been no large accumulation to depress values. Ammonia, lump, is quoted at $3.50 per 100 lb., ground at $3.65 per 100 lb., and powdered at $3.85 per 100 lb. Potash alum of foreign make is still available on spot at $2.75 per 100 lb.

Arsenic—More activity was reported last week. Considerable stocks have been held on spot for a long time. Some of this arsenic originally cost 13c. per lb. and practically all of it represents a higher cost price than buyers are willing to pay at present. Evidently some holders have lost confidence in any recovery in values and are trying to unload without incurring further storage charges. Sales of carlots were made at 7½c. per lb. and less than carlots at 7¾c. per lb. Domestic producers are offering round lots at 7⅞c. per lb.

Cream of Tartar—Spot holdings of imported cream of tartar have been reduced and where offerings were available at 20c. a short time ago, the asking price was moved up last week to 21c. per lb. and sales were made at that figure.

Copper Sulphate — Imported grades are practically out of the spot market and the prices asked for shipment from abroad show a strengthening tendency with 4⅜@4½c. per lb. asked for forward positions. The rise in the metal market has had a similar effect on values for domestic sulphate. As high as 4⅝c. per lb. has been quoted for the latter but there is a range according to seller and quality with 4½c. per lb. quoted in some directions.

Sal Ammoniac—Foreign markets for white sal ammoniac have been lower and cables have indicated that shipments to this country could be secured at 5¾c. per lb. This has given an easier feeling regarding values for spot holdings but the latter are still quoted at 6¼c. per lb.

Sulphate of Ammonia — Export inquiries were in the market and brought out the fact that stocks in sellers hands were small. Production has been curtailed and while there are prospects of a larger output in the near future, the market, at least temporarily is in a firm position. Quotations for export are given at $2.75 per 100 lb., f.o.b. Atlantic ports and $2.85 per 100 lb., f.o.b. Pacific ports.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	165.78
Last week	164.12
Aug., 1923	168.00
Aug., 1922	152.00
Aug., 1921	158.00
Aug., 1920	264.00
Aug., 1919	251.00
Aug., 1918	278.00

Higher prices for crude cottonseed oil, refined glycerine and ammonium sulphate resulted in a net gain of 166 points in the weighted index number.

Alcohol

Denatured alcohol was firm at the recent advance, with new business coming forward in a larger way. Continued strength in basic materials was a feature in the market. Formula No. 1, special, held at 46c. per gal., in drums, carload lots. Formula No. 5, completely denatured, was offered at 45c per gal., in drums, carload lots.

Methanol was inactive, but a steady undertone prevailed in most quarters, due to smaller production. Pure, in tank cars, closed unchanged at 75c. per gal., f.o.b. works.

Butanol was firm at 30c. per lb., production being sold up. Demand was good.

Coal-Tar Products

Light Oils Firm on Limited Production—Slight Increase in Call for Intermediates—Consuming Trades More Active

PRICE changes in the market for coal-tar products were few. The situation in benzene underwent little change, stocks being just about equal to the demand and all sellers firm in their views. Reports from the steel mills were more encouraging, but there has been no actual increase in by-product coke oven operations. Higher quotations were named for sulphate of ammonia, production in most directions being sold up. Phenol was offered at unchanged prices, with the undertone steady as producers were not anxious to force the market under present conditions. Naphthalene was in better request, the call coming from intermediate makers. Aniline oil showed signs of increased buying interest. There has been moderate improvement in the demand for intermediates, reflecting better conditions in some of the consuming industries.

Aniline Oil and Salt—Producers reported a better inquiry and the market closed steady at 16@17c. per lb., drums extra, the inside price obtaining for carload business, f.o.b. works. Exports of aniline oil and salt for the 12 months ended June 30 amounted to 262,799 lb., which compares with 492,087 lb. for the corresponding period a year ago.

Benzene—Leading producers reported that little material was available for nearby delivery as there has been no change in the situation at producing centers. The selling schedule was maintained at 23c. per gal. on the 90 per cent grade, and 25c. per gal. on the pure, tank cars, f.o.b. works. Exports of benzene for the 12 months ended June 30 amounted to 100,384,912 lb., which compares with 78,727,250 lb. a year ago.

Beta-naphthol—There was a moderate inquiry for small lots. The market, however, ruled steady, first hands asking from 24@25c. per lb., the inside figure prevailing on round lots for shipment from works.

Creosote—The market for domestic creosote was a nominal affair, production being sold up. Foreign offerings have increased, but with buying interest lacking the undertone continues easy. Manchester quotes creosote in bulk at 5¾@6d. per gal., works. Exports from the United Kingdom for the first 6 months of 1924 amounted to 18,769,196 gal., which compares with 26,204,279 gal. for the corresponding period a year ago.

Cresylic Acid—Supplies appeared to be ample and the market fairly steady, On the 97 per cent grade holders were asking from 63@68c. per gal., immediate delivery.

H-acid—There were sellers at 72@75c. per lb., with the undertone slightly firmer in some quarters of the trade.

Naphthalene — Intermediate makers showed more buying interest in the crude material. Prices closed about unchanged, with the undertone favoring buyers. Flake on spot was available at 4¾@5c. per lb. Crude to import held at 2c. per lb. for good quality.

Phenol—U.S.P. material was offered at 24@25c. per lb., in drums, immediate delivery. Small lots sold at the outside figure. Producers were not disposed to force the market as business is expected to show considerable improvement in the near future.

Pyridine — Spot offerings moderate and prices firm at $3.90@$4 per gal. Imports for the first 6 months of the year officially reported at 280,330 lb., valued at $97,014.

Vegetable Oils and Fats

Nearby Cottonseed Oil Higher—Linseed Oil Futures Unsettled—Coconut and Palm Oils Up—Tallow in Demand

THE tendency of prices for vegetable oils for immediate and nearby delivery was upward, stocks in most instances being subnormal. Both crude and refined cottonseed oil sold at new highs for the season. Coconut oil scored further gains on covering by shorts. Tin plate manufacturers were buyers of palm oil. Lubricating oil producers again entered the market for rapeseed oil. Active inquiry was reported for refined sesame oil, but business was restricted by lack of offerings from abroad. Linseed oil for immediate delivery was firm, but easier prices were named on last quarter deliveries. China wood oil was steady. Soap makers were interested in additional purchases of tallow.

Cottonseed Oil — August delivery prime summer yellow sold on the Produce Exchange at 15c. per lb., in bbl., a new high for the movement. With holdings of cottonseed oil even smaller than a year ago and offerings of new crop crude comparatively light the situation in old crop material continues to favor sellers. Reports on the cotton crop have been more favorable and sentiment on futures was mixed, although net changes for the week in the distant positions were rather unimportant. Owing to the firm market for pure lard speculative traders were not aggressive on the bear side. With corn at $1.10 per bu., cheap lard appears out of the question. Chicago offered pure lard, cash, at 13.82c. per lb. Late in the week prime summer yellow cottonseed oil in the option market was quoted at 14.25@15c. per lb. for August, 13.52@13.55c. for September, 12.39@12.41c. for October and 10.92@10.94c. for December. Crude oil sold at 11⅝c. per lb., tank cars, f.o.b. mills, August delivery, which compares with 11.25c. bid a week ago. Bleachable oil was nominal at 13¾@14c. per lb., loose, Texas. Lard compound in the New York market was advanced to 16@16½c. per lb. The cotton crop, according to the Aug. 1 report of the Department of Agriculture, is estimated at 12,351,000 bales.

Linseed Oil—The scarcity in spot oil continues, but the better crop news from the Northwest and Canada brought out an easier feeling in futures. Some of the crushers advised buyers to hold off. According to traders crushers were anxious to retard buying of oil so as to depress the seed markets, as purchases of seed for fall requirements have been comparatively small. Few crushers have a surplus of oil for delivery this side of October and this explains the premium asked on nearby deliveries. Further business was put over in foreign oil, one crusher and a linoleum maker being credited with buying in the English market. Domestic trade was inactive. There were sellers of August oil at $1.02, first half of September at $1, second half of September at 98c., October at 94c. and October-December at 92c. per gal., cooperage basis, carload lots. It was intimated that 92c. might be shaded on November-December business. The second official report on the Canadian crop places estimated production at 8,526,400 bu., which compares with 6,100,000 bu. on July 1, and 7,139,000 bu., the final for 1923. Production of linseed oil in the United States during the second quarter of the year is estimated at 440,467 bbl.

China Wood Oil—A tank car sold at at 14c. per lb., New York. Prompt shipment from the Pacific coast, in sellers' tank cars, closed at 12⅜@13c.

Vegetable Oil Imports for Fiscal Year Smaller

There was a marked decrease in imports of coconut, palm, linseed and soya bean oils in the 12 months ended June 30, compared with the corresponding period a year ago. Sesame oil imports did not receive separate classification in the official statistics on foreign trade, but private estimates place the total for the fiscal year at 8,000,000 lb. Imports of vegetable oils and whale oil, for the fiscal year, with a comparison, follow:

	1923-24	1922-23
China wood, lb.	80,898,400	89,392,385
Coconut, lb.	181,230,319	212,573,417
Olive, edible, lb.	80,880,745	74,625,925
Olive, tech. gal.	1,512,789	*5,684,772
Olive foots, lb.	ƒ14,942,688	....
Palm, lb.	86,784,400	118,815,952
Palm kernel, lb.	ƒ1,101,155	....
Peanut, lb.	15,057,865	7,552,512
Rapeseed, gal.	2,068,373	1,769,831
Linseed, lb.	17,839,646	56,763,728
Soya bean, lb.	17,631,210	38,635,381
Other veg't. oils, lb.	11,043,289	....
Whale, gal.	4,735,909	2,703,657

* Includes olive oil foots (sulphur oil)
ƒ Beginning Jan. 1, 1924.

per lb., with September-October at 12½c. and October forward at 12¼c. per lb. Demand fair and market steady.

Coconut Oil—Offerings of nearby oil scanty and market higher on good inquiry. Sales of prompt shipment from coast at 9⅜@9½c. per lb., tank car basis. On futures 9⅛@9¼c. asked, Pacific coast points. In New York Ceylon type oil in tank cars, prompt shipment, nominal at 9¾@9⅞c. per lb.

Corn Oil—Crude oil sold at 12c. per lb., tank cars, f.o.b. point of production in the Middle West.

Other Vegetable Oils—Lagos palm oil sold at 8.25c. per lb., September-December delivery. Later 8.35c. asked on September-October shipment from Africa. Niger on spot scarce and nominal at 8½c., with futures available at 8c. per lb. Refined rapeseed oil sold for remainder of year delivery at 85c. per gal.; spot firm at 87@87½c. per gal. Sesame oil, refined, sold at 13c. per lb., nearby delivery; futures firm at 12¼@12½c., according to position. Crude soya bean oil nominal at 10⅝c. per lb., tank cars, duty paid, August shipment from coast.

Tallow, Etc.—Bids at 8½c. per lb. for extra special tallow were turned down, and market closed firm at 8⅝c. asked. Yellow grease firm at 7⅝c. per lb. Oleo stearine sold at 16¼@16½c. per lb., an advance of ¾c.

Miscellaneous Materials

Antimony—Improved demand from actual consumers strengthened the market and caused prices to advance ¼c. per lb. in the past week. Chinese antimony now quoted at 9⅛@9¼c. per lb., with Cookson's "C" grade at 11⅜@11⅝c. per lb. Chinese needle, lump, nominal at 8½@9c. per lb.

Glycerine—There was a strong market for all grades. Soap lye, crude, basis 80 per cent, sold at 11½c. per lb., loose, f.o.b. point of production Middle West, while in this territory 11¾c. represented the market. Dynamite nominal at 17½c. per lb., in drums. Chemically pure advanced to 18@18½c. per lb., in drums, the inside figure obtaining on round lots.

Naval Stores—Spirits of turpentine in better demand and market higher at 90c. per gal., in bbl. Rosins fairly active and firm, the lower grades closing at $5.80@$6.00 per bbl., an advance of 10c. Export inquiry better.

Shellac—With foreign markets firmer and exchange higher traders advanced prices from 1 to 2c. per lb. Actual business showed only moderate improvement. T. N. on spot closed at 53@54c. per lb. Imports of shellac for the 12 months ended June 30 according to the Department of Commerce, amounted to 28,511,593 lb., valued at $15,170,791, which compares with 32,772,776 lb., valued at $21,034,532 for the corresponding period a year ago.

Orange Mineral—Effective Aug. 11 corroders advanced the market ½c. Orange mineral in casks of 800-lb. is now held at 14c. per lb., and in bbl. of 500-lb., at 14½c. per lb.

Litharge—Reflecting a higher market for pig lead corroders advanced the price of litharge ½c. per lb., establishing the carload lot quotation at 10½c. per lb., in bbl. or casks. Demand continues good.

Red Lead — Dry red lead was advanced to 11c. per lb., in bbl. or casks, carload basis, a net gain of ½c. for the week. The new price became effective on Aug. 11. The price of red lead in oil remained unchanged.

White Lead — Standard dry white lead, basic carbonate, held at 9¾c. per lb. Demand was good and, with pig lead higher, the undertone was firm in all quarters. Sublimed white lead, basic sulphate, was offered by leading producers at 9½c. per lb. Pig lead advanced ½c., the market closing firm on good buying at 7⅝c. per lb.

Zinc Oxide — Exports for the 12 months ended June 30 amounted to 7,528,004 lb., which compares with 10,613,881 lb. a year ago. The market was steady in sympathy with the metal, but first hands maintained the selling schedule at 7⅝c. per lb. on the lead free, American process.

Imports at the Port of New York

August 8 to August 14

ACIDS—Phenol—3 kegs, Liverpool, Monsanto Chemical Works; 24 dr. and 11 cs., Liverpool, Order. **Phosphoric** — 83 cs., Hamburg, Irving Bank-Col. Trust Co.

ALBUMEN—30 cs., Shanghai, McAndrews & Forbes Co.; 35 cs., Tientsin, French Kreme Co.; 56 cs., Shanghai, S. W. Bridges Co.; 30 cs., Tientsin, A. Klipstein & Co.; 24 cs., Tientsin, Order.

ALUMINUM HYDRATE—225 bg. Rotterdam, Meteor Products Co.

ALUMINUM SULPHATE — 140 pkg., Rotterdam, R. W. Greeff & Co.; 1 cs., Marseilles, Harris Import & Export Co.

AMMONIUM OXALATE—20 csk., Rotterdam, Kuttroff, Pickhardt & Co.

AMMONIUM PERCHLORATE — 300 kegs, Manchester, Order.

AMMONIUM SULPHATE—25 bg., Rotterdam, Kuttroff, Pickhardt & Co.

ANTHRACENE—205 bg., Manchester, Order.

ANTIMONY ORE—614 bg., Antofagasta, W. R. Grace & Co.

ARSENIC—1 bbl., Melbourne, Order; 86 bbl. Tampico, American Metal Co.; 100 cs., Yokohama (at San Francisco), Order; 10 csk., London, L. H. Butcher & Co.

BARYTES—100 bg., Genoa, National City Bank; 40 bbl. and 400 bg., Geona, Order; 100 bg., Genoa, R. W. Greeff & Co.

BLANC FIXE—80 csk., London, Toch Bros.

BRONZE POWDER—20 cs., Bremen, Gerstendorfer Bros.; 18 cs., Bremen, L. Uhlfelder.

CALCIUM CARBONATE—6 csk., London, Yardley & Co.

CALCIUM CHLORIDE—154 dr., Rotterdam, Superfos Co.

CHALK—1,100,000 kilos (in bulk), Dunkirk, Taintor Trading Co.; 1,288 bg., Antwerp, National City Bank; 175 csk., Bristol, H. J. Baker & Bro.; 21 csk., Bristol, Schieffelin & Co.; 67 csk., Antwerp, Guaranty Trust Co.; 950 bg., Antwerp, Order; 800,000 kilos crude, Dunkirk, J. W. Hegman Co.; 500 tons, London, Taintor Trading Co.

CHEMICALS—2 cs., Southampton, Mallinckrodt Chemical Works; 40 cs., Rotterdam, R. W. Greeff & Co.; 80 csk., Rotterdam, Hans Henricks Chem. Co.; 26 cs., Rotterdam, Merck & Co.; 4 pkg. aniline, Rotterdam, Kuttroff, Pickhardt & Co.; 5 pkg. do., Rotterdam, H. A. Metz & Co.; 1 cs., Rotterdam, Pfaltz & Bauer; 52 pkg., Rotterdam, Order; 8 csk., Bristol, Order; 100 csk., Hamburg, Jungmann & Co.

CHINA CLAY—200 bg. Bristol, Am. Clay Pipe Works; 92 bg., Bristol, Order.

COLORS—16 bbl. aniline, Genoa, Irving Bank-Col. Trust Co.; 8 cs. do., Genoa, Order; 3 cs. aniline, Rotterdam, Grasselli Dyestuff Corp.; 10 csk. bleachers blue, Liverpool, A. De Ronda & Co.; 2 csk aniline, Rotterdam, Ciba Co.; 8 cs. dry, Rotterdam, Reichard-Coulston, Inc.; 8 cs. aniline, Havre, Order; 54 cs., Hamburg, M. Grumbacher.

CRESOL—11 csk. solid Liverpool, Order.

CUTCH—2,000 bg., Singapore, Order.

DIVI-DIVI—15 cs., Maracaibo, P. R. Rincones Co.; 3,976 bg., Ouracao, R. Desvernine.

FULLERS EARTH—100 bg., Bristol, L. A. Salomon & Bros.; 100 bg., London, Gallagher & Ascher; 600 bg., London, L. A. Salomon & Bros.

GAMBIER—253 cs., Singapore, Order.

GRAPHITE—150 bg., Marseilles, Order.

GUMS—22 cs. copal, Antwerp, Order; 41 pkg. tragacanth, Southampton, W. Mohrmann; 65 bg. manjak, Barbados, F. W. Clardon; 1,011 bg. copal, Matadi, L. C. Gillespie & Sons; 100 cs. damar, Batavia, American Exchange National Bank; 300 cs. damar, Batavia, Catz American Corp.; 100 cs. damar, Batavia, Order; 100 bg. arabic, Port Sudan, Order; 132 pkg. copal, Macassar, Kidder, Peabody & Co.; 311 pkg. do., Macassar, Irving Bank-Col. Trust Co.; 150 bg. copal, Singapore, Baring Bros. & Co.; 512 bg. damar and 56 cs. do., Singapore, Order; 74 bg. copal, Antwerp, Chase National Bank.

HYDROGEN PEROXIDE—67 cs., Hamburg, Order.

IRON OXIDE—50 bbl., Bristol, G. Z. Collins & Co.; 65 csk., Liverpool, J. A. McNulty; 10 csk., Liverpool, Order; 4 csk., Liverpool, Order; 12 csk., Hull, J. Lee Smith & Co.; 75 bbl., Malaga, E. M. & F. Waldo.

LITHOPONE—500 csk., Antwerp, Benjamine Moore & Co.

LOGWOOD EXTRACT—100 csk., Kingston, American Dyewood Co.

MAGNESITE — 105 csk. and 313 bg., Rotterdam, Speiden, Whitfield Co.; 2 csk. calcined, Hull, F. Stearn & Co.

MAGNESIUM CITRATE—346 cs., Genoa, E. J. Petrosmolo.

MANGANESE—600 bg., Port Antilla, A. P. Rice.

MINERAL WHITE — 100 bg., Hull, Whittaker, Clark & Daniels; 100 bg., Hull, L. A. Salomon & Bros.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

CHEMICALS, heavy, and dyes. Bahia, Brazil. Purchase and agency. —11,145.

CHEMICALS, industrial. Porto Alegre, Brazil. Agency.—11,148.

COLORS, dry for paints. Caracas, Venezuela. Agency.—11,153.

ACID, carbolic. Calcutta, India. Purchase.—11,250.

AMMONIA. Buenos Aires, Argentina. Agency.—11,214.

CHEMICALS, heavy. Buenos Aires, Argentina. Agency.—11,214.

DYESTUFFS and intermediates. Turin, Italy. Purchase.—11,251.

PAINTS and rosin. Bahia, Brazil. Agency.—11,212.

PAINTS and varnishes. Calcutta, India. Purchase and agency.—11,254.

SODA, caustic. Shanghai, China. Purchase.—11,216.

SODA, caustic. Behia, Brazil. Agency.—11,215.

ZINC SULPHIDE. Berlin, Germany. Purchase.—11,211.

COTTONSEED OIL. Tangier, Morocco. Purchase.—11,203.

NAPHTHALENE—556 bg., Rotterdam, Calco Chemical Co.; 51 pkg., Manchester, Order.

OCHER—23 bbl., Malaga, Hummel & Robinson; 396 csk., Marseilles, Reichard-Coulston, Inc.

OILS—Cod—50 csk., St. Johns, Order; 61 csk., Halifax, Cook & Swan Co. **Coconut**—915 tons (at San Francisco) Manila, Order; 916 tons, Manila, Spencer Kellogg & Sons; 848 tons, Cebu, Philippine Refining Corp. **Castor**—56 bbl., Hull, Order. **Linseed**—96 dr., Rotterdam, Order; 87 bg. oxidized, Hull, Nairn Linoleum Co.; 100 bbl., Hull, Order. **OLIVE FOOTS** (sulphur oil)—200 bbl. Naples, Banca Comm'l Italiano; 200 bbl., Genoa, Order. **Palm**—16 csk., Antwerp, Niger Co.; 396 csk., Antwerp, Holder Bill of Lading; 1,718 csk., Matadi, Niger Co.; 23 csk., Liverpool, Order; 90 bbl., Liverpool, Order; 928 csk., Hamburg, African & Eastern Trading Co.; 170 csk., Hamburg, F. Fehr & Co. **Rapeseed**—375 bbl., Hull, J. C. Francesconi & Co.; 444 bbl., Hull, Order. **Seal**—60 csk. and 294 tons (in bulk), St. Johns, Cook & Swan. **Sesame**—75 bbl., Rotterdam, National City Bank; 200 bbl., Rotterdam, Elbert & Co.; 100 bbl., Hull, Order; 146 bbl., Rotterdam, Lockwood & Co. **Soya Bean**—195 dr. Hamburg, Order.

OIL SEEDS—Castor—64 bg., Port au Prince, S. L. Brinley. **Copra**—1,545 bg., Macassar, National City Bank; 373 bg., Port Antonio, United Fruit Co. **Linseed**—25,254 bg., Buenos Aires, Order.

PITCH—40 bbl. cottonseed oil, Rotterdam, Elbert & Co.

POTASSIUM SALTS—200 bg. sulphate, Bremen, Potash Importing Corp of America; 84 bbl. perchlorate, Havre, C. Hardy, Inc.; 4,000 bg. muriate, Antwerp, Societe Comm. des Potasses d'Alsace; 1000 bg. sulphate, Hamburg, Potash Importing Corp. of America; 17 dr. caustic, Hamburg, Panama Pacific Line; 16 dr. do., Hamburg, Order.

PYRITES—4,501,560 kilos, Huelva, The Pyrites Co.

QUEBRACHO—4,785 bg. extract, Buenos Aires, Tannin Corp.; 430 bg. do., Buenos Aires, Order; 15,157 logs, Santa Fe, Tannin Corp.; 5014 logs, Buenos Aires, Tannin Corp.

ROCHELLE SALTS — 66 csk., Rotterdam, W. Neuberg.

ROSIN—100 cs., Piraeus, Nassiakos Importing Co.; 200 cs., Piraeus, J. D. Papadeas.

SAL AMMONIAC—254 csk., Rotterdam, Kuttroff, Pickhardt & Co.

SHELLAC — 28 cs., Rotterdam, C. F. Gerlach; 19 cs., Rotterdam, Order; 50 bg., Liverpool, Ralli Bros.; 220 cs., Havre, Javitz & Son.

SILVER SULPHIDES — 9 cs., Pacasmayo, Bank of Central & South America.

SODIUM SALTS—220 cs. cyanide, Havre, American-Hawaiian S. S. Co.; 33,623 bg. nitrate, Tocopilla, W. R. Grace & Co.; 500 bg. fluoride, Rotterdam, Order; 20 kegs hydrosulphite, Liverpool, Kuttroff, Pickhardt & Co.; 116 dr. cyanide, Liverpool, Order; 13,768 bg. nitrate, Iquique, W. R. Grace & Co.; 20 cs. bromide, Hamburg, Irving Bank-Col. Trust Co.; 100 csk. hyposulphite, Hamburg, Order; 86 csk. fluoride, Rotterdam, E. Suter & Co.; 10 cs. peroxide, Rotterdam, F. E. Wallace.

STARCH—250 bg. potato, Rotterdam, Spier, Simmons & Co.

TALC—400 bg., Genoa, Kountze Bros.; 1,000 bg., Genoa, Coty, Inc.; 200 bg., Genoa, L. A. Salomon & Bros.; 300 bg., Genoa, C. Mathieu; 200 bg., Genoa, Bonito Bros.; 500 bg., Genoa, Italian Discount & Trust Co.; 350 bg., Genoa, Bankers Trust Co.; 200 bg., Genoa, Order; 200 bg., Genoa, L. A. Salomon & Bros.

TARTAR—371 bg., Oran, Tartar Chemical Works; 348 bg., Oran, C. Pfizer & Co.; 44 csk., Leghorn, Royal Baking Powder Co.; 25 bg., Argostoli, A. N. Davis; 377 bg., Alicante, C. Pfizer & Co.; 46 cs., Valencia, Order; 300 bg., Marseilles, C. Pfizer & Co.; 200 bg., Marseilles, Royal Baking Powder Co.; 145 bg., Valencia, C. Pfizer & Co.

UMBER—1050 bg., Leghorn, Reichard-Coulston, Inc.; 49 csk., Liverpool, L. H. Butcher & Co.; 18 csk., Hull, Reichard-Coulston, Inc.

VANADIUM—3,599 bg., Callao, Vanadium Corp. of Am.

WAXES—503 bg. carnauba, Pernambuca, Order; 15 bg. crude beeswax, Leghorn, Order; 10 pkg. crude beeswax, Valparaiso, W. R. Grace & Co.; 4,000 bg. paraffine, Balikpapan, Asiatic Petroleum Co.; 2 bg. beeswax, Arroya, D. Steengrafe; 17 bg. beeswax, Hamburg, Order; 400 bg. paraffine, Marseilles, Order.

WHITING—1,000 bg., Havre, Hammill & Gillespie.

WOOL GREASE—50 csk. refined, Bremen. Pfaltz & Bauer.

ZINC OXIDE—4 csk., London, Yardley & Co.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums, wks.	lb.	$0.16 –	$0.16½
Acetic anhydride, 85%, dr.	lb.	.34 –	.36
Acid, acetic, 28%, bbl.	100 lb.	3.12 –	3.37
Acetic, 56%, bbl.	100 lb.	5.85 –	6.10
Acetic, 80%, bbl.	100 lb.	8.19 –	8.44
Glacial, 99½%, bbl.	100 lb.	11.01 –	11.51
Boric, bbl.	lb.	.09 –	.09½
Citric, kegs	lb.	.46 –	.47
Formic, 85%	lb.	.12½ –	.13
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.12½ –	.13
22% tech., light, bbl.	lb.	.06 –	.06½
Muriatic, 18° tanks	100 lb.	.80 –	.85
Muriatic, 20°, tanks	100 lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04½ –	.05½
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl.	lb.	.09½ –	.09¾
Phosphoric, 50% carboys	lb.	.07 –	.08
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	8.00 –	9.00
Sulphuric, 60°, drums	ton	12.00 –	13.00
Sulphuric, 66°, tanks	ton	13.00 –	14.00
Sulphuric, 66° drums	ton	17.00 –	18.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.27 –	.28
Tartaric, domestic, bbl.	lb.	.29 –	.30
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.30 –	....
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.85 –	....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.83 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.52 –	...
No. 1, 190 proof, special, dr.	gal.	.46 –	...
No. 1, 188 proof, bbl.	gal.	.55 –	...
No. 1, 188 proof, dr.	gal.	.49 –	...
No. 5, 188 proof, bbl.	gal.	.51 –	...
No. 5, 188 proof, dr.	gal.	.45 –	...
Alum, ammonia, lump, bbl.	lb.	.03½ –	.04
Potash, lump, bbl.	lb.	.02¾ –	.03¼
Chrome, lump, potash, bbl.	lb.	.05½ –	.06
Aluminum sulphate, com., bags	100 lb.	1.35 –	1.40
Iron free bags	lb.	2.35 –	2.45
Aqua ammonia, 26°, drums	lb.	.06½ –	.06¾
Ammonia, anhydrous, cyl.	lb.	.28 –	.30
Ammonium carbonate, powd. tech., casks	lb.	.12½ –	.12¾
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	2.50 –	2.60
Antimony oxide, white, bbl.	lb.	.09½ –	.10
Arsenic, white, powd., bbl.	lb.	.07½ –	.07¾
Arsenic, red, powd., kegs	lb.	.14½ –	.15½
Barium carbonate, bbl.	ton	59.00 –	60.00
Barium chloride, bbl.	ton	77.00 –	78.00
Barium dioxide, 88%, drums	lb.	.17½ –	.18
Barium nitrate, casks	....	.08½ –	.08¾
Blanc fixe, dry, bbl.	lb.	.03½ –	.04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	....
Spot N. Y. drums	100 lb.	2.20 –	2.25
Borax, bbl.	lb.	.05 –	.05¼
Bromine, cases	lb.	.34 –	.38
Calcium acetate, bags	100 lb.	3.00 –	3.05
Calcium arsenate, dr.	lb.	.09 –	.09½
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½ –	.07½
Camphor, Jap. cases	lb.	.68 –	.69
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.06½ –	.07
Chalk, precip.—domestic, light, bbl.	lb.	.04½ –	.04¾
Domestic, heavy, bbl.	lb.	.03½ –	.04
Imported, light, bbl.	lb.	.04½ –	.05
Chlorine, liquid, tanks, wks.	lb.	.04½ –	....
Contract, tanks, wks.	lb.	.04½ –	....
Cylinders, 100 lb., wks.	lb.	.05½ –	.07½
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	15.00 –	16.00
Copper carbonate, bbl.	lb.	.17 –	.17½
Copper cyanide, drums	lb.	.45 –	.46
Copper oxide, kegs	lb.	.16½ –	.17
Coppersulphate, dom., bbl.	100 lb.	4.50 –	4.75
Imp bbl.	100 lb.	4.37½ –	4.50
Cream of tartar, bbl.	lb.	.21 –	.21¼
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.30 –	1.35
Epsom salt U.S.P., dom., bbl.	100 lb.	2.10 –	2.35
Ether, U.S.P., dr concent'd.	lb.	.13 –	.14
Ethyl acetate, 85%, drums	gal.	.92 –	.95
Ethyl acetate, 99%, dr.	gal.	$1.08 –	$1.10
Formaldehyde, 40%, bbl.	lb.	.09 –	.09½
Fullers earth—f.o.b. mines	ton	7.50 –	18.00
Furfural, works, bbl.	lb.	.25 –	....
Fusel oil, ref., drums	gal.	2.75 –	3.50
Fusel oil, crude, drums	gal.	1.50 –	1.75
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.92
Glycerine, c.p., drums extra	lb.	.18 –	.18½
Glycerine, dynamite, drums	lb.	.17½ –	....
Glycerine, crude 80%, loose	lb.	.11½ –	....
Hexamethylene, drums	lb.	.65 –	.70
Lead:			
White, basic carbonate, dry, casks	lb.	.09¾ –	....
White, basic sulphate, casks	lb.	.09½ –	....
White, in oil, kegs	lb.	.11¾ –	.12½
Red, dry, casks	lb.	.11 –	....
Red, in oil, kegs	lb.	.12¾ –	.13½
Lead acetate, white crys., bbl.	lb.	.14½ –	....
Brown, broken, casks	lb.	.13½ –	....
Lead arsenate, powd., bbl.	lb.	.16 –	.18
Lime-Hydrated, bg, wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10½ –	....
Lithopone, bags	lb.	.06¼ –	.06¾
Magnesium carb., tech., bags	lb.	.08½ –	.08¾
Methanol, 95%, bbl.	gal.	.74 –	.76
Methanol, 97%, bbl.	gal.	.76 –	.78
Methanol, pure, tanks	gal.	.75 –	....
drums	gal.	.78 –	.80
bbl	gal.	.83 –	.85
Methyl-acetone, t'ks.	gal.	.70 –	....
Nickel salt, double, bbl.	lb.	.09 –	.10½
Nickel salts, single, bbl.	lb.	.10 –	.11
Orange mineral, csk	lb.	.14 –	.14½
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Phosphorus, yellow, cases	lb.	.37½ –	.40
Potassium bichromate, casks	lb.	.09 –	.09¼
Potassium bromide, gran., bbl.	lb.	.25 –	.38
Potassium carbonate, 80-85%, calcined, casks	lb.	.05½ –	.05¾
Potassium chlorate, powd.	lb.	.07 –	.08¾
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.07½ –	.08
Potassium hydroxide (caustic potash) drums	lb.	.06½ –	.06¾
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.06 –	.07½
Potassium permanganate, drums	lb.	.13½ –	.14
Potassium prussiate, red, casks	lb.	.36 –	.38
Potassium prussiate, yellow, casks	lb.	.18 –	.18½
Salammoniac, white, gran., casks, imported	lb.	.06½ –	.06¾
Salammoniac, white, gran., bbl., domestic	lb.	.07½ –	.08
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk) works	ton	16.00 –	18.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	2.85 –	3.05
Sodium acetate, works, bbl.	lb.	.04½ –	.05
Sodium bicarbonate, bulk	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07 –	.07¼
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½ –	.04¾
Sodium chlorate, kegs	lb.	.06½ –	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08½ –	$0.09
Sodium hyposulphite, bbl.	lb.	.02½ –	.02¾
Sodium nitrite, casks	lb.	.08½ –	.09
Sodium peroxide, powd., cases	lb.	.23 –	.27
Sodium phosphate, dibasic, bbl.	lb.	.03½ –	.03¾
Sodium prussiate, yel. bbl.	lb.	.09½ –	.10
Sodium salicylic, drums	lb.	.38 –	.40
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03 –	.03¼
Sodium sulphite, crys., bbl.	lb.	.02 –	.02½
Strontium nitrate, powd., bbl.	lb.	.09½ –	.10
Sulphur chloride, yel drums	lb.	.04½ –	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08
Tin bichloride, bbl.	lb.	.14 –	.....
Tin oxide, bbl.	lb.	.52 –	.....
Tin crystals, bbl.	lb.	.35½ –	.....
Zinc carbonate, bags	lb.	.12 –	.14
Zinc chloride, gran, bbl.	lb.	.06 –	.07½
Zinc cyanide, drums	lb.	.36½ –	.37
Zinc dust, bbl	lb.	.08½ –	.08¾
Zinc oxide, lead free, bag	lb.	.07¼ –	.....
5% lead sulphate, bags	lb.	.06¾ –	.....
10 to 35 % lead sulphate, bags	lb.	.06¾ –	......
French, red seal, bags	lb.	.09¾ –	......
French, green seal, bags	lb.	.10¾ –	......
French, white seal, bbl.	lb.	.11½ –	......
Zinc sulphate, bbl.	100 lb.	3.00 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.65
Alpha-naphthol, ref., bbl.	lb.	.65 –	.75
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salt, bbl.	lb.	.21 –	.22
Anthracene, 80%, drums	lb.	.70 –	.75
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	.....
f.f.c. drums	lb.	1.60 –	.....
tech, drums	lb.	68	.72
Benzene, pure, water-white, tanks, works	gal.	.25 –	....
Benzene, 90%, tanks, works	gal.	.23 –	....
Benzidine base, bbl.	lb.	.80 –	.82
Benzidine sulphate, bbl.	lb.	.70 –	.72
Benzoic acid, U.S.P., kegs	lb.	.75 –	85
Benzoate of soda, U.S.P., bbl.	lb.	.65 –	.70
Benzyl chloride, 95-97%, ref. carboys	lb.	.35 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl.	lb.	.24 –	.25
Beta-naphthylamine, tech.	lb.	.65 –	.70
Cresol, U.S.P., drums	lb.	.22 –	.26
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.63 –	.65
95-97%, drums, works	gal.	.58 –	.60
Dichlorbenzene, drums	lb.	.07 –	.08
Diethylaniline, drums	lb.	.53 –	.58
Dimethylaniline, drums	lb.	.35 –	.36
Dinitrobenzene, bbl.	lb.	.15 –	.17
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.18 –	.20
Dip oil, 25%, drums	gal.	.26 –	.28
Diphenylamine, bbl.	lb.	.48 –	.50
H-acid, bbl.	lb.	.72 –	.75
Meta-phenylenediamine, bbl.	lb.	.95 –	1.00
Michlers ketone, bbl.	lb.	3.00 –	3.25
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	1.20 –	1.30
Naphthalene, flake, bbl.	lb.	.04½ –	.05¼
Naphthalene, balls, bbl.	lb.	.05½ –	.05½
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.60 –	.62
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl.	lb.	.25 –	.27
Nitro-toluene, drums	lb.	.13½ –	.14
N-W acid, bbl.	lb.	1.00 –	1.05
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.12 –	.13
Ortho-nitrophenol, bbl.	lb.	.95 –	1.00
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl.	lb.	.13 –	.14
Para-aminophenol, base, kegs	lb.	1.20 –	1.25
Para-aminophenol, HCl, kegs	lb.	1.30 –	1.40
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitraniline, bbl.	lb.	.68 –	.70
Para-nitrotoluene, bbl.	lb.	.50 –	.55
Para-phenylenediamine, bbl.	lb.	1.35 –	1.45
Para-toluidine, bbl	lb.	.75 –	.80
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.24 –	.26
Picric acid, bbl.	lb.	.20 –	22
Pitch, tanks, works	ton	27.00 –	30.00
Pyridine, imp., drums	gal.	3.90 –	4.00
Resorcinol, tech., kegs	lb.	1.30 –	1.40

Resorcinol, pure, kegs	lb.	$2.00 - $2.25
R-salt, bbl	lb.	.50 - .55
Salicylic acid, tech., bbl	lb.	.32 - .33
Salicylic acid, U.S.P., bbl	lb.	.35 - ....
Solvent naphtha, water-white, tanks	gal.	.25 - ....
Crude, tanks	gal.	.22 - ....
Sulphanilic acid, crude, bbl	lb.	.16 - .18
Tolidine, bbl	lb.	1.00 - 1.05
Toluidine, mixed, kegs	lb.	.30 - .35
Toluene, tank cars, works	gal.	.26 - ....
Toluene, drums, works	gal.	.30 - ....
Xylidine, drums	lb.	.40 - .42
Xylene, 5 deg.-tanks	gal.	.40 - ....
Xylene, com., tanks	gal.	.28 - ....

Naval Stores

Rosin B-D, bbl	280 lb.	$5.80 - $5.85
Rosin E-I, bbl	280 lb.	5.95 - 6.05
Rosin K-N, bbl	280 lb.	6.10 - 6.20
Rosin W.G.-W.W., bbl	280 lb.	7.20 - 7.70
Wood rosin, bbl	280 lb.	5.40 - 5.50
Turpentine, spirits of, bbl	gal.	.90 - ....
Wood, steam dist., bbl	gal.	.74 - ....
Wood, dest. dist., bbl	gal.	.56 - ....
Pine tar pitch, bbl	200 lb.	5.50 - ....
Tar, kiln burned, bbl	500 lb.	10.50 - ....
Retort tar, bbl	500 lb.	10.50 - ....
Rosin oil, first run, bbl	gal.	.38 - ....
Rosin oil, second run, bbl	gal.	.43 - ....
Rosin oil, third run, bbl	gal.	.48 - ....
Pine oil, steam dist	gal.	.60 - ....
Pine tar oil, com'l	gal.	.30 - ....

Animal Oils and Fats

Degras, bbl	lb.	$0.03½ - $0.05½
Grease, yellow, loose	lb.	.07½ - .07¾
Lard oil, Extra No. 1, bbl	gal.	.84 - .85
Lard compound, bbl	lb.	.16 - .16½
Neatsfoot oil 20 deg. bbl	gal.	1.28 - ....
No. 1 bbl	gal.	.82 - .84
Oleo Stearine		.16½ - .16½
Oleo oil, No. 1, bbl	lb.	.16 - ....
Red oil distilled, d.p. bbl	lb.	.09 - .09½
Saponified, bbl	lb.	.09 - .09½
Tallow, extra, loose works	lb.	.08½ - ....
Tallow oil, acidless, bbl	gal.	.84 - .86

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.16½ - ......
Castor oil, No. 1, bbl	lb.	.17 - ....
Chinawood oil, bbl	lb.	.14½ - .15
Coconut oil, Ceylon, bbl	lb.	.10½ - .10¾
Ceylon, tanks, N.Y.	lb.	.09½ - .09¾
Coconut oil, Cochin, bbl	lb.	.10½ - .11¼
Corn oil, crude, bbl	lb.	.13½ - .13¾
Crude, tanks, (f.o.b. mill)	lb.	.12 - ....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.11½ - ....
Summer yellow, bbl	lb.	.15 - ....
Winter yellow, bbl	lb.	.15½ - .16
Linseed oil, raw, car lots, bbl.	gal.	1.02 - ....
Raw, tank cars (dom.)	gal.	.96 - ....
Boiled, cars, bbl. (dom.)	gal.	1.04 - ....
Olive oil, denatured, bbl	gal.	1.15 - 1.20
Sulphur, (foots) bbl	lb.	.09½ - .09¾
Palm, Lagos, casks	lb.	.08½ - ....
Niger, casks	lb.	.08 - ....
Palm kernel, bbl	lb.	.09½ - ....
Peanut oil, crude, tanks (mill)	lb.	.12½ - .13
Peanut oil, refined, bbl	lb.	.16½ - .17
Perilla, bbl	lb.	.14 - .14½
Rapeseed oil, refined, bbl	gal.	.87 - .87½
Sesame, bbl	lb.	.13 - .13½
Soya bean (Manchurian), bbl.	lb.	.12 - .12½
Tank, f.o.b. Pacific coast	lb.	.10½ - ....
Tank, (f.o.b. N.Y.)	lb.	.11 - .11½

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.58 - $0.60
Menhaden, light pressed, bbl.	gal.	.62 - ....
White bleached, bbl	gal.	.64 - ....
Blown, bbl	gal.	.66 - ....
Crude, tanks (f.o.b. factory)	gal.	.50 - ....
Whale No. 1 crude, tanks, coast	lb.	....
Winter, natural, bbl	gal.	.75 - .76
Winter, bleached, bbl	gal.	.78 - .79

Oil Cake and Meal

Coconut cake, bags	ton	$33.00 - 34.00
Cottonseed meal, f.o.b. mills	ton	44.00 - 45.00
Linseed cake, bags	ton	44.00 - .....
Linseed meal, bags, spot	ton	46.00 - .....

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.50 - $0.55
Albumen, egg, tech, kegs	lb.	.95 - .97
Cochneal, bags	lb.	.33 - .35
Cutch, Borneo, bales	lb.	.04½ - .04¾
Cutch, Rangoon, bales	lb.	.13½ - .14½
Dextrine, corn, bags	100 lb.	4.52 - 4.57
Dextrine gum, bags	100 lb.	4.82 - 5.09
Divi-divi, bags	ton	40.00 - 42.00
Fustic, sticks	ton	30.00 - 35.00
Fustic, chips, bags	lb.	.04 - .05
Gambier com., bags	lb.	.12½ - .13
Logwood, sticks	ton	25.00 - 26.00
Logwood, chips, bags	lb.	.02½ - .03
Sumac, leaves, Sicily, bags	ton	125.00 - 130.00
Sumac, ground, bags	ton	123.00 - .....
Sumac, domestic, bags	ton	50.00 - 55.00
Starch, corn, bags	100 lb.	3.87 - 4.08
Tapioca flour, bags	lb.	.04½ - .06

Extracts

Archil, conc., bbl	lb.	$0.16 - $0.19
Chestnut, 25% tannin, tanks.	lb.	.01½ - .02
Divi-divi, 25% tannin, bbl	lb.	.05 - .05½
Fustic, crystals, bbl	lb.	.20 - .22
Fustic, liquid, 42°, bbl	lb.	.08 - .09
Gambier, liq., 25% tannin, bbl.	lb.	.11 - .11½
Hematine crys., bbl	lb.	.14 - .18
Hemlock, 25% tannin, bbl	lb.	.03½ - .04
Hypernic, solid, drums	lb.	.22 - .24
Hypernic, liquid, 51°, bbl	lb.	.12 - .13
Logwood, crys., bbl	lb.	.14 - .15
Logwood, liq., 51°, bbl	lb.	.07½ - .08½
Osage Orange, 51°, liquid, bbl.	lb.	.07 - .08
Osage Orange, powder, bg	lb.	.14 - .15
Quebracho, solid, 65% tannin, bbl	lb.	.04½ - .04¾
Sumac, dom., 51°, bbl	lb.	.06½ - .06¾

Dry Colors

Blacks-Carbongas, bags, f.o.b. works, contract	lb.	$0.09 - $0.11
spot, cases	lb.	.12 - .16
Lampblack, bbl	lb.	.12 - .40
Mineral, bulk	ton	35.00 - 45.00
Blues-Bronze, bbl	lb.	.36 - .38
Prussian, bbl	lb.	.36 - .38
Ultramarine, bbl	lb.	.07 - .35
Browns, Sienna, Ital., bbl	lb.	.05 - .12
Sienna, Domestic, bbl	lb.	.03 - .03½
Umber, Turkey, bbl	lb.	.04 - .04½
Greens-Chrome, C.P. Light, bbl	lb.	.28 - .30
Chrome, commercial, bbl	lb.	.11 - .11½
Paris, bulk	lb.	.24 - .26
Reds, Carmine No. 40, tins	lb.	4.25 - 4.50
Iron oxide red, casks	lb.	.08 - .12
Para toner, kegs	lb.	.95 - 1.00
Vermilion, English, bbl	lb.	1.30 - 1.35
Yellow, Chrome, C.P. bbls	lb.	.17 - .17½
Ocher, French, casks	lb.	.02 - .03

Waxes

Bayberry, bbl	lb.	$0.21 - $0.21½
Beeswax, crude, Afr. bg	lb.	.25 - .26
Beeswax, refined, light, bags	lb.	.32 - .34
Beeswax, pure white, cases	lb.	.40 - .41
Candellila, bags	lb.	.23 - .23½
Carnauba, No. 1, bags	lb.	.34 - .36
No. 2, North Country, bags	lb.	.25 - .27
No. 3, North Country, bags	lb.	.21 - .22
Japan, cases	lb.	.18 - .18½
Montan, crude, bags	lb.	.05½ - .06
Paraffine, crude, match, 105-110 m.p., bbl	lb.	.05½ - ....
Crude, scale 124-126 m.p. bags	lb.	.04¾ - .05
Ref., 118-120 m.p., bags	lb.	.05½ - ....
Ref., 123-125 m.p., bags	lb.	.05½ - ....
Ref., 128-130 m.p., bags	lb.	.05¾ - ....
Ref., 133-135 m.p., bags	lb.	.06½ - .07
Ref., 135-137 m.p., bags	lb.	.07½ - .07½
Stearic acid, sgle pressed, bags	lb.	.11½ - .11½
Double pressed, bags	lb.	.11¾ - .12
Triple pressed, bags	lb.	.12½ - .13

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$7.50 - $7.75
Ammonium sulphate, bulk f.o.b. works	100 lb.	2.65 - ....
Blood, dried, bulk	unit	4.10 - 4.15
Bone, raw, 3 and 50, ground	ton	26.00 - 28.00
Fish scrap, dom., dried, wks.	unit	3.50 - ....
Nitrate of soda, bags	100 lb.	2.47 - ....
Tankage, high grade, f.o.b. Chicago	unit	2.50 - ....
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	3.25 - 3.70
Tennessee, 75%	ton	6.75 - 7.00
Potassium muriate, 80%, bags	ton	34.55 - ....
Potassium sulphate, bags basis 90%	ton	45.85 - ....
Double manure salt	ton	26.35 - ....
Kainit	ton	7.22 - ....

Crude Rubber

Para—Upriver fine	lb.	$0.26½ - ....
Upriver coarse	lb.	.19 - ....
Upriver caucho ball	lb.	.19 - ....
Plantation—First latex crepe	lb.	.26½ - ....
Ribbed smoked sheets	lb.	.25½ - ....
Amber crepe No. 1	lb.	.26½ - ....

Gums

Copal, Congo, amber, bags	lb.	$0.08 - $0.10
East Indian, bold, bags	lb.	.13 - .14
Manila, pale, bags	lb.	.18 - .19
Pontinak, No. 1 bags	lb.	.19 - .20
Damar, Batavia, cases	lb.	.23 - .23½
Singapore, No. 1, cases	lb.	.26 - .26½
Singapore, No. 2, cases	lb.	.18 - .18½
Kauri, No. 1, cases	lb	.58 - .64
Ordinary chips, cases	lb.	.21 - .22
Manjak, Barbados, bags	lb.	.06 - .09

Shellac

Shellac, orange fine, bags	lb.	$0.55 - $0.56
Orange superfine, bags	lb.	.57 - .58
A. C. garnet, bags	lb.	.54 - ....
Bleached, bonedry	lb.	.64 - ....
Bleached, fresh	lb.	.53 - ....
T. N., bags	lb.	.53 - .54

Miscellaneous Materials

Asbestos, crude No. 1 f.o.b., Quebec	sh. ton	$300.00 - $400.00
Asbestos, shingle, f.o.b. Quebec	sh. ton	50.00 - 70.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 - 25.00
Barytes, grd., white, f.o.b. mills, bbl	net ton	16.00 - 17.00
Barytes, grd., off-color, f.o.b. Balt	net ton	13.00 - 14.00
Barytes, floated, f.o.b. St. Louis, bbl	net ton	23.00 - 24.00
Barytes, crude f.o.b. mines, bulk	net ton	8.00 - 9.00
Casein, bbl., tech	lb.	.11½ - .12½
China clay (kaolin) crude, No. 1, f.o.b. Ga	net ton	7.00 - 8.00
Washed, f.o.b. Ga	net ton	8.50 - 9.00
Powd., f.o.b. Ga	net ton	14.00 - 20.00
Crude f.o.b. Va	net ton	6.00 - 8.00
Ground, f.o.b. Va	net ton	13.00 - 19.00
Imp., lump, bulk	net ton	15.00 - 20.00
Imp., powd	net ton	45.00 - 50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	6.50 - 7.25
No. 2 f.o.b. N.C.	long ton	4.50 - 5.00
No. 1 gr'd. N. C.	long ton	15.32 - 21.00
No. 1 Canadian, f.o.b. mill, powd	long ton	20.00 - ....
Graphite, Ceylon, lump, first quality, bbl	lb.	.05½ - .06
Ceylon, chip, bbl	lb.	.04½ - .05
High grade amorphous crude	ton	15.00 - 35.00
Gum arabic, amber, sorts, bags	lb.	.11½ - .11¾
Gum tragacanth, sorts, bags	lb.	.50 - .51
No. 1, bags	lb.	1.20 - ....
Kieselguhr, f.o.b. Cal	ton	40.00 - 42.00
F.o.b. N. Y	ton	50.00 - 55.00
Magnesite, calcined, f.o.b. Cal.	ton	35.00 - 45.00
Pumice stone, imp., casks	lb.	.03 - .40
Dom., lump, bbl	lb.	.06 - .08
Dom., ground, bbl	lb.	.03 - .05
Silica, glass sand, f.o.b. Ind.	ton	2.00 - 2.25
Silica, sand blast, f.o.b. Ind.	ton	2.25 3.50
Silica, amorphous, 200-mesh, f.o.b. Ill.	ton	20.00 - ....
Silica, glass sand, f.o.b. Ill.	ton	2.00 - 2.50
Soapstone, coarse, f.o.b. Vt., bags	ton	7.50 - 8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	10.50 - ....
Talc, 200 mesh, f.o.b. Ga., bags	ton	9.50 - 10.00
Talc, 325 mesh, f.o.b. New York, grade A bags	ton	14.75 - ....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.75 - $3.00
Corning	bbl.	1.75 - ......
Cabell	bbl.	1.45 - ......
Somerset	bbl.	1.55 - ......
Illinois	bbl.	1.62 - ......
Indiana	bbl.	1.63 - ......
Kansas and Okla. under 28 deg.	bbl.	.90 - ......
California, 35 deg. and up	bbl.	1.40 - ......

Gasoline, Etc.

Motor gasoline, steel bbls	gal.	$0.19 - ......
Naphtha, V. M. & P. deod, steel bbls	gal.	.18 - ....
Kerosene, ref. tank wagon	gal.	.13 - ......
Bulk, W.W. delivered, N.Y.	gal.	.07½ - .07¾
Lubricating oils:		
Cylinder, Penn., filtered	gal.	.29 - .32
Bloomless, 30@31 grav.	gal.	.20 - .21
Paraffin, pale 885 vis.	gal.	.15½ - .16½
Spindle, 200, pale	gal.	.21 - .21½
Petrolatum, amber, bbls	lb.	.04 - .04½
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140-$145
Chrome brick, f.o.b. Eastern shipping points	ton	50- ..
Chrome cement, 40-50% Cr_2O_3	ton	23-27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42-45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35-38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65-68
9-in. arches, wedges and keys	ton	80-85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48-50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48-50
F.o.b. Mt. Union, Pa.	1,000	38-39
Silicon carbide refract. brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 - ......

Ferrochromium, per lb. of Cr, 1-2% C	lb.	\$0 30 –	....
4-6% C	lb.	.12½–	....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr.ton	100.00 –	....
Spiegeleisen, 19-21% Mn.	gr.ton	35.00 –	36.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 –	2.25
Ferrosilicon, 10-12%	gr. ton	39.50 –	43.50
50%	gr. ton	72.00 –	75.00
Ferrotungsten, 70-80% per lb. of W	lb.	.90 –	.93
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50 –	....
Ferrovanadium, 30-40% per lb. of V	lb.	3.25 –	3.75

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	\$5.50 –	\$8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3.	ton	22.00 –	....
C.i.f. Atlantic seaboard	ton	19 00 –	23.00
Coke, fdry., f.o.b. ovens	ton	4.00 –	4.50
Coke, furnace, f.o.b. ovens	ton	3.00 –	3.25
Fluorspar, gravel, f.o.b. mines, Illinois	ton	22.00 –	23.50
Ilmenite, 52% TiO_2 Va.	lb.	.01½–	....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.42 –	.46
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80 –	....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.12 –	....
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	....
Rutile, 94@96% TiO_2	lb.	.12 –	.15
Tungsten, scheelite, 60% WO_3 and over	unit	9.25 –	....
Tungsten, wolframite, white, 60% WO_3	unit	9.00 –	9.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	12.50
Vanadium pentoxide, 99%	lb.	2.50 –	4.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	\$0.13¼–	.13½
Aluminum, 98 to 99%	lb.	.26½–	.28
Antimony, wholesale, Chinese and Japanese	lb.	.09½–	.09¾
Nickel, 99%	lb.	.27 –	.30
Monel metal, shot and blocks	lb.	.32	
Tin, 5-ton lots, Straits	lb.	.52¼	
Lead, New York, spot	lb.	.07¼	
Lead, E. St. Louis, spot	lb.	.07⅛	
Zinc, spot, New York	lb.	.0655	
Zinc, spot, E. St. Louis	lb.	.0620	
Silver (commercial)	oz.	.68¼	
Cadmium	lb.	.60	
Bismuth (500 lb. lots)	lb.	2.45–2.50	
Cobalt	lb.	2.50–3.00	
Magnesium, ingots, 99%	lb.	.90–.95	
Platinum, refined	oz.	120.00	
Iridium	oz.	260.00–270.00	
Palladium, refined	oz.	78.00–83.00	
Mercury	75 lb.	72.00–72.50	
Tungsten powder	lb.	.95–1.00	

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	20.37½
Copper bottoms	29.25
Copper rods	20.00
High brass rods	17.25
High brass rods	15.00
Low brass wire	19.50
Low brass rods	20.00
Brazed bronze tubing	24.75
Seamless copper tubing	22.75
Seamless high brass tubing	21.50

OLD METALS—The following are the dealers purchasing prices in cents per pound:

Copper, heavy and crucible	10.75 @ 11.00
Copper, heavy and wire	10.25 @ 10.37½
Copper, light and bottoms	8.50 @ 8.75
Lead, heavy	6.25 @ 6.50
Lead, tea	3.50 @ 3.62½
Brass, heavy	5.50 @ 6.00
Brass, light	5.00 @ 5.25
No. 1 yellow brass turnings	6.75 @ 7.25
Zinc scrap	4.00 @ 4.25

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	\$3.34	\$3.34
Soft steel bars	3.24	3.24
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.09	4.09
Plates, ¼ to 1 in. thick	3 34	3.34

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Arkansas

GLENWOOD—The Industrial Laboratories, Tulsa, Okla., have plans under way for the development of local clay, tripoli carbon and silicate properties, to include commercial reduction plants, with works for the manufacture of art pottery products, special mortars, soaps and affiliated specialties. The machinery installation will include grinding, pulverizing, refining and other machinery, of which a list will be arranged at once. Dr. Joel McDonald is director, in charge.

HOT SPRINGS—The American Foundry Co., recently organized, has plans under way for the establishment of a local foundry for the manufacture of iron castings, including sewer pipe, etc., with reported cost placed at \$35,000. W. F. Fullington is president, and T. M. Fullington, vice-president and general manager.

California

SAN DIEGO—The Vitrified Products Corp., Jefferson St., North San Diego, has commenced extensions and improvements in its local clay products manufacturing plant, to include the installation of additional equipment to double approximately the present output. The work is estimated to cost \$100,000.

REDWOOD CITY—The Pacific Portland Cement Co. has work nearing completion on a new local cement mill, and plans to place the unit in service at an early date. It is said that the initial works will be expanded in the future.

LONG BEACH—The Pacific Steel Mfg. Co. is perfecting plans for the construction of a new local plant in the harbor district, and has awarded a contract to the Merritt, Scott & Chapman Salvaging Co., for dredging work at the site. Awards for other features of the mill will be let in the future; the erection will be carried out under a day labor plant. The new plant is estimated to cost in excess of \$100,000, with machinery.

Illinois

WOOD RIVER—The Roxana Petroleum Corp., Arcade Bldg., St. Louis, Mo., has plans under way for the construction of a new lubricating oil compounding and manufacturing plant at Roxana, near Wood River, to be operated in conjunction with its oil refining plant at this location. The new works will consist of a number of 1-story units, estimated to cost close to \$1,000,000, with machinery, which will be designed to provide for an initial output of approximately 200 bbl. per day. Thomas F. Lydon is vice-president.

Indiana

INDIANAPOLIS—The National Malleable & Steel Castings Co., 546 South Holmes Ave., has awarded a general contract to the Hall Construction Co., Board of Trade Bldg., for the erection of its proposed 1-story plant addition, estimated to cost \$100,000, with equipment. The new structure will be used primarily for annealing service. The company has taken out a permit to raze an existing building on the site at South Holmes Ave. and Michigan St.

GARY—An explosion of gas in a blast furnace at the plant of the United States Steel Corp., Aug. 4, destroyed a large portion of the stack and adjoining property, with loss reported in excess of \$1,000,000. The furnace had been out of commission for several weeks past for relining and repairs, and was being made ready for blowing in. It is said that it will be rebuilt in the near future.

Maryland

BALTIMORE—The Maryland Oil Co., American Bldg., Louis Blaustein, president, has preliminary plans under advisement for the construction of a new oil storage and distributing plant on site selected at Wilmington, Del., to be 1- and 2-story, estimated to cost in excess of \$80,000, with equipment. T. J. O'Connell is company architect.

BALTIMORE—The Everlastone Products Corp., 828 West Pratt St., manufacturer of composition products, contemplates the early rebuilding of the portion of its plant destroyed by fire, Aug. 6. An official estimate of loss has not been announced. Additional equipment will be installed. Albert R. Rankin is general manager.

BALTIMORE—The Johns Hopkins University has construction in progress on its proposed chemistry building at Homewood, estimated to cost \$1,000,000, with equipment. Funds are being secured for the completion of the structure at the earliest date, the work to be carried out in conjunction with a general expansion program involving more than \$16,000,000, for new buildings, equipment, etc.

Michigan

FLINT—The Flint Malleable Castings Co., 318 Dayton Bldg., John Barringer, manager, is taking bids on a general contract until Aug. 29, for the construction of its proposed 1-story foundry, 140x380 ft., on the Bristol Rd. A portion of the building will be used for office service. Wright & Nice, Flint, are architects.

Mississippi

MERIDIAN—The Hattiesburg Creosoting Co., Hattiesburg, Miss., W. E. Eddins, president, is perfecting plans for the construction of a wood-treatment and creosoting plant on local site, estimated to cost about \$35,000, including equipment. Foundations will be laid at an early date.

HOLLY SPRINGS—The Magnolia Clay Products Co., Holly Springs, recently organized, has plans under way for the erection of a local plant for the manufacture of tile and other pottery products, with reported cost placed at \$35,000, including equipment. The company has clay deposits in Benton and Marshall Counties, and will install machinery for development and production. The company is headed by F. E. West, Holly Springs; and A. J. Cook, 1780 Autumn St., Memphis, Tenn.

Missouri

JOPLIN—E. I. du Pont de Nemours & Co., Wilmington, Del., have acquired the local plant and properties of the General Explosives Co., and will develop the works for the production of high explosives, to be operated in conjunction with its other powder plants.

New Jersey

JERSEY CITY—The New York Blue Print Paper Co., 96 Reade St., New York, has plans for extensions and improvements in its local plant on Terrace Ave., near Lincoln St., 1- and 3-story, 35x100 ft., estimated to cost \$30,000. John Helmers, 135 Summit Ave., West Hoboken, N. J., is architect.

PERTH AMBOY—The C. Pardee Works, Inc., manufacturer of floor tile, etc., has awarded a general contract to the Foundation Co., 120 Liberty St., New York, for the construction of a new addition, for which foundations will be laid at an early date.

HAWTHORNE—The Textile Dyers Co. of America, care of J. C. Van Vlandren, 140 Market St., Paterson, N. J., architect, has awarded a general contract to the John W. Ferguson Co., 152 Market St., Paterson, for the erection of a 2-story tin reclaiming plant at Hawthorne, near Paterson, estimated to cost \$25,000.

New York

NEW YORK—The American Sugar Refining Co., 117 Wall St., has preliminary plans under way for the construction of a new refining plant in the harbor section, designed primarily to replace a present obsolete refinery on South 2nd St., Brooklyn. The project is said to involve from \$3,500,000 to \$5,000,000, and will be financed by the sale of the company's holdings in the Great Western Sugar Co., Denver, Colo., totaling about \$9,538,560. The new refining plant will include a power house, machine shop and auxiliary building. Earl D. Babst is president.

BUFFALO—The Standard Oil Co. of New York, Fidelity Bldg., with headquarters at 26 Broadway, New York, has acquired property on Grand Island, near Tonawanda, and plans for the early construction of a new oil storage and distributing works, with total initial capacity of close to 2,500,000 gals. The company is also said to be considering the erection of a new refinery and byproducts plant at this same location.

BROOKLYN—The Gleason-Tiebout Glass Co., 93 Commercial St., will make extentions and improvements in its plant for increase in capacity, including the installation of a new lehr. A contract for the latter has been let to the Amsler-Morton Co., Fulton Bldg., Pittsburgh, Pa.

North Dakota

MINOT—The Minot Starch Co., will hold in abeyance the erection of its proposed 3-story addition, estimated to cost $45,000, for which plans were prepared recently by Bell & Kinport, 1645 Hennepin Ave., Minneapolis, Minn., architects. It is expected to proceed with the work at a later date. F. A. Youngman is secretary.

Ohio

TOLEDO—The Toledo Furnace Co., has work in progress on extensions and improvements at its iron and steel works, to include the construction of a new furnace to replace an existing old unit, new pig iron mill and other structures for considerable increase in capacity, estimated to cost in excess of $1,500,000, with equipment.

SEBRING—The French China Co., is proceeding with extensions at its plant and the construction of a new decorating kiln, representing an investment in excess of $75,000, to be ready for service late in the fall. The company purposes to begin work at an early date on new shops and kiln house, replacing existing structures, with installation of additional equipment to provide for large increase in output.

SANDUSKY—The Sandusky China Co., 304 West Adams St., is reported to have preliminary plans under way for the construction of an addition to its pottery for extensive increase in capacity. W. J. Frey is one of the heads of the company in charge.

WARREN—The General Electric Co., has work under way on extensions and improvements in its local Niles Division glass works, used for the production of electric light bulbs, etc. A larger furnace unit will be installed for operating the glass blowing machines, as well as several new bulb machines and accessory equipment.

Oklahoma

WILSON—The Nyanza Refining Co., has plans under consideration for extensions and betterments in its local oil refining plant, with the installation of additional equipment, estimated to cost $125,000. It is expected to begin work at an early date.

Pennsylvania

CONSHOHOCKEN—The Pennsylvania Glass Co., has acquired under lease the former local plant of the Hummel Steel Foundry Co., and will remodel and equip the structures for a new works for the manufacture of glass tubing and kindred products. It is expected to have the plant ready for service early in the fall.

PARKERS LANDING—The Wightman Bottle & Glass Co. will make improvements in its plant, including equipment replacements and repairs. The works have been closed down temporarily to carry out the program.

South Carolina

CHARLESTON—The Merchants' Fertilizer & Phosphate Co. is said to be planning for the rebuilding of the portion of its plant recently destroyed by fire with loss estimated at $150,000, including equipment. The reconstruction is expected to cost close to a like amount.

Tennessee

CHATTANOOGA—The Signal Mountain Portland Cement Co. has preliminary plans under advisement for the construction of a new unit at its cement mill, estimated to cost close to $500,000, with machinery. It will make the third such producing unit.

Texas

BURKBURNETT—The American Refining Co. has tentative plans for the rebuilding of the portion of its local oil refining plant, recently destroyed by fire with loss approximating $55,000, including equipment.

TEXAS CITY—Following the completion of the first unit of its gasoline refining plant, to be operated under a special electrical process, the Knox Process Corp. purposes to construct a number of additional units at the plant, with ultimate works of 6 individual operating units. Each will represent an investment of approximately $400,000, with stoves and equipment. The company was organized recently, and will operate with a capital of $3,000,000.

TEXAS CITY—The Swiftsure Petroleum Co. has construction in progress on a new oil storage and distributing plant on local site, estimated to cost in excess of $50,000, with equipment. It will have a capacity of 275,000 bbl.

West Virginia

WHEELING—The Wheeling Glass Mfg. Co. has taken over the plant and business of the North Wheeling Glass Bottle Co., 2nd St., and will operate in conjunction with its present works. Extensions and betterments are planned, including the installation of additional equipment, estimated to cost $75,000.

Wisconsin

NORTH MILWAUKEE—The Greenebaum Tanning Co., Hampton Ave., is taking bids for the erection of a 2-story tannery addition, 110 x 113 ft. The Gates Engineering Co., 418 Jackson St., are engineers.

New Companies

GEORGIA FERTILIZER Co., Columbus, Ga.; commercial fertilizer products; $50,000. Incorporators: J. W. Howard, O. C. Bullock and J. T. Fletcher, Murrah Bldg., Columbus.

INTERNATIONAL SMELTER & GENERATOR Co., Denver, Colo.; operate a metal smelting and refining plant; $500,000. Incorporators: H. Schwartz, H. L. Nott and J. E. Stelzer. Representative: E. G. Kindred, 308 Ideal Bldg., Denver.

RED BANK OIL Co., INC., Red Bank, N. J.; refined oil products; $125,000. Incorporators: Waldo H. Goetsch, Robert Staunton and Frank V. Bakeman, 48 Throckmorton St., Red Bank. The last noted is representative.

ART TILE Co., St. Petersburg, Fla.; ceramic tile products; $25,000. Incorporators: C. S. Moss and W. E. Wakeman, Apartment No. 7, 4th Ave. and 4th St., North, St. Petersburg.

EARTH-RICH Co., New York, N. Y.; chemicals and chemical byproducts; $750,000. Incorporators: I. Port, E. Friberg and D. Power. Representative: A. M. Grill, 34 Wall St., New York.

LEE-PHILLIPS OIL Co., Rockdale, Tex.; petroleum products; $50,000. Incorporators: John E. Lee, E. A. Camp and Y. T. McCormick, all of Rockdale.

SOUTHERN ARSENIC & MINERAL PRODUCTS Co., care of the Corporation Trust Co. of Delaware, Dover, Del., representative; operate reduction and refining plants for commercial mineral production; $5,300,000.

CONCRETE WATERPROOFING Co., Room 1608, 105 West Monroe St., Chicago, Ill.; waterproofing products; $10,000. Incorporators: Louis A. Carlson, M. J. Besser and L. H. Dall.

F. E. FANNELL & Co., INC., Staunton, Va.; chemicals and affiliated products; $10,000. Incorporators: F. E. Fannell, Staunton; and H. B. Wallace. The first noted will be president.

STEWART MFG. Co., Santa Monica, Cal.; organized; concrete and magnesite products. Dell H. Stewart, 1441 Ocean Front, Santa Monica, is head.

FINCH CHEMICAL Co., Utica, N. Y.; chemicals and chemical byproducts; $60,000. Incorporators: D. T., W. T., and R. F. Finch. Representative: Martin & Randell, Utica, attorneys.

DEXTORA Co., Indianapolis, Ind.; chemicals and kindred products; $40,000. Incorporators: John R. Barrett, Edward D. Evans and George M. Duffy, all of Indianapolis.

SOUTHERN OIL & REFINING Co., Shreveport, La.; refined petroleum products, carbon black, etc.; $750,000. Incorporators: R. L. Henry, Houston, Tex.; L. H. Gray, El Dorado, Ark.; and W. G. Banks, 871 Margaret Pl., Shreveport.

JOHNSON & ARNOLD PAINT Co., INC., Birmingham, Ala.; paints, oils, varnishes, etc.; capital not noted. Incorporators: Robert D. Arnold, W. C. Johnson and Palmer H. Bell, Jefferson County Bank Bldg., Birmingham.

LOXA DISTRIBUTING Co., INC., care of the American Guaranty & Trust Co., 1600 Delaware Ave., Wilmington, Del., representative; chemicals and chemical compounds; $100,000.

DAYTON CHEMICAL Co., Dayton, O.; chemicals and chemical byproducts; $300,000. Incorporators: F. E. Huston and Herbert S. Stafford, both of Dayton.

HARNER & BRICKNER, INC., New York, N. Y.; commercial mineral products, and operate reduction plants for same; $50,000. Incorporators: W. H. Barr and W. G. Staudenmeier. Representative: I. M. Brickner, Rochester, N. Y., attorney.

COVERT OIL & REFINING Co., Kansas City, Mo.; refined petroleum products, petroleum byproducts, etc.; $30,000. Incorporators: R. K. and Joseph S. Covert, and G. W. Duvall, American Bank Bldg., Kansas City.

TILO ROOFING Co., INC., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del.; representative; ceramic tile products; $500,000.

ARKANSAS MINERAL PRODUCTS Co., INC., Little Rock, Ark.; operate reduction plants for commercial mineral products; $16,000. Incorporators: J. M. Ensor, and A. W. Hall, 120 Prospect St., Little Rock.

BANCROFT W. HENDERSON & Co., INC., New York, N. Y.; rubber products; 100 shares of stock, no par value. Incorporators: B. Low, B. Prince and M. T. Weiss. Representative: Bondy & Schloss, 276 5th Ave., New York.

WATER SEAL ROOFING TILE Co., Austin, Tex.; cement tile products; capital not noted. Incorporators: C. H. Page, David Hewlett and Henry Wattinger, all of Austin.

SUPER CUSHION TIRE Co., Akron, O.; automobile tires and other rubber products; $50,000. Incorporators: Mac C. and Charles R. Lampman, both of Akron.

TROY FOUNDRY Co., Colonie, N. Y.; iron and steel castings, etc.; $350,000. Incorporators: A. E. Hodgkins, H. P. Parrock and H. T. Clement. Representative: G. Murphy, Troy, N. Y., attorney.

FULLER COTTON OIL Co., Snyder, Tex.; cotton oil products; $250,000. Incorporators: M. A. and P. L. Fuller, and A. D. Erwin, all of Snyder.

ALBUS SILK SOAP Co., INC., Birmingham, Ala.; soaps, washing compounds, etc.; $20,000. Incorporators: A. C. Roth and E. P. Allen, both of Birmingham.

A. B. C. OIL CORP., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del., representative; refined petroleum products; $500,000.

Industrial Notes

GEORGE N. SPIVA, chairman of the board of directors of the General Explosives Co., announces the sale of that corporation's property to the du Pont Co. The only plant of the company is one near Joplin, Mo., which is the largest explosive plant in the southwest. This was taken over August 1 by the du Pont Co. The purchase price was not announced but the General Explosives Co. was capitalized at $1,000,000 when it was organized in 1916 by Spiva.

THE DE LAVAL STEAM TURBINE Co., Trenton, N. J. announces that the Wm. Constable Co., Providence Bldg., Duluth, Minn., will henceforth represent it, having purchased the H. J. Rich Co., the former representative. The territory covered by the Wm. Constable Co. includes Minnesota north of the southern boundaries of the counties of Wilkin, Ottertail, Todd, Morrison, Mille Lacs, Kenebec and Pine; Wisconsin north of the southern boundaries of the counties of Burnett, Washburn, Sawyer, Price, Oneida, Forrest and Marinette; and the entire Northern Peninsula of Michigan. Mr. Constable was chief mechanical and electrical engineer for the Republic Iron and Steel Co. of Duluth, for the past five years, and previously was connected with the General Electric Co. in the mining, locomotive and steam turbine department at Duluth. G. C. Kahl, 404 Dwight Bldg., Kansas City, Mo., has been appointed sales representative of the De Laval Steam Turbine Co. in Arkansas, Nebraska, Kansas and Oklahoma, Iowa west of the north and south line through Des Moines but not including Des Moines, and Missouri west of and including Jefferson Ctiy. Mr. Kahl was formerly connected with the Thermal Efficiency Co., representing the De Laval Co. in Kansas City.